

KEYBOARD, POWER SUPPLY, SYSTEM BOARD

SPERRY
MODEL HT

CSCS20

CSCS20

SPERRY
MODEL HT



SAFETY PRECAUTIONS

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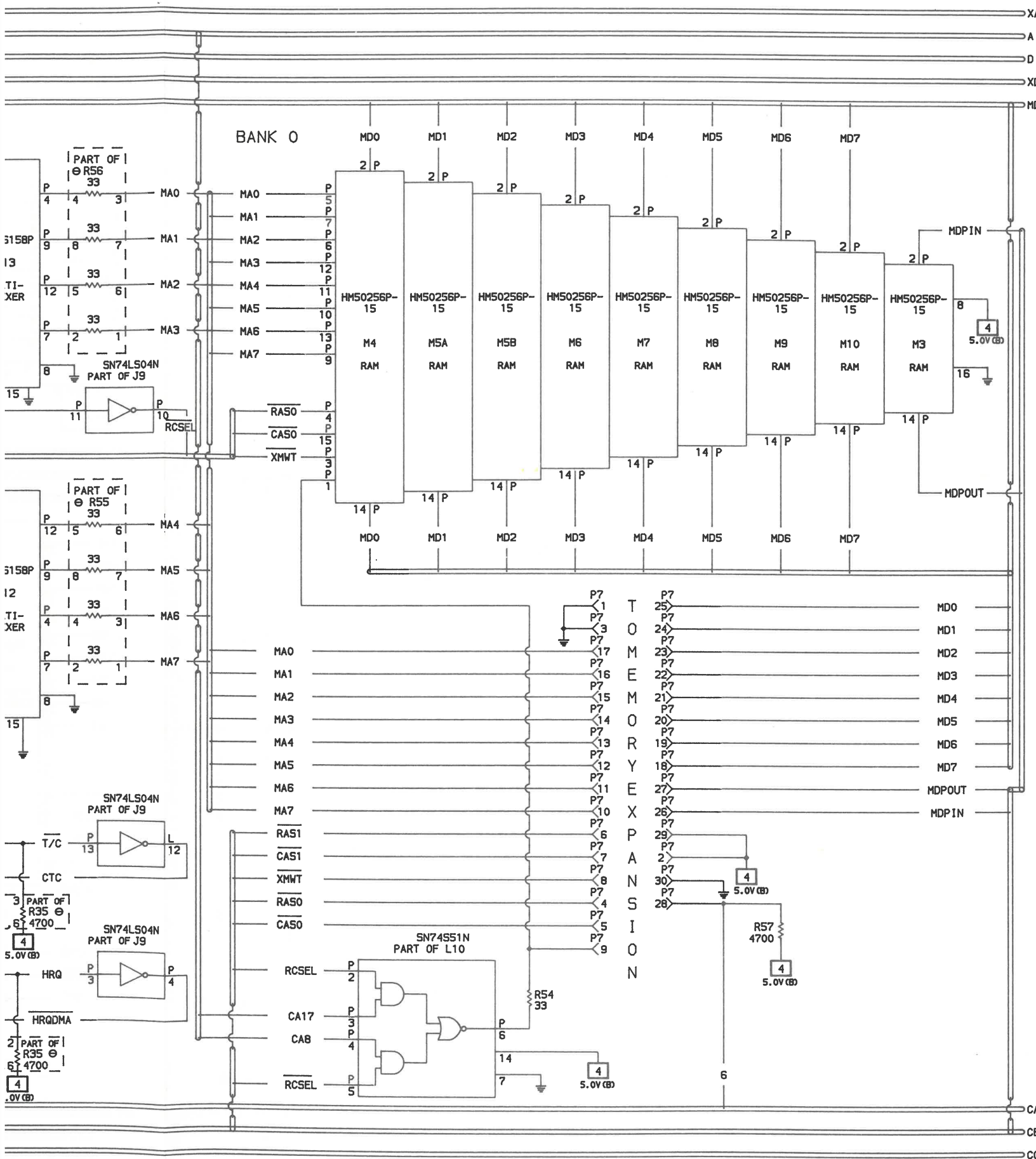
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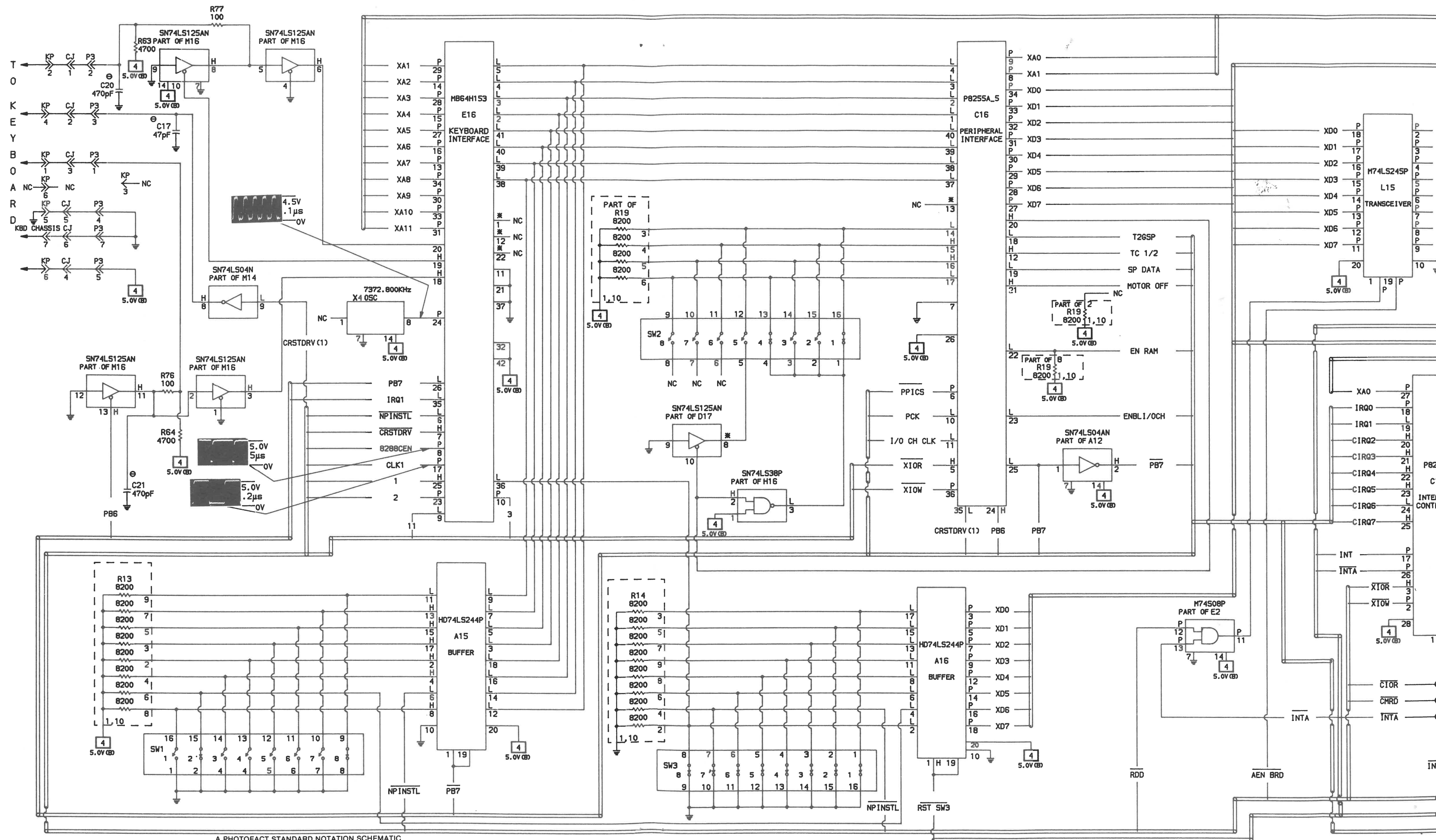
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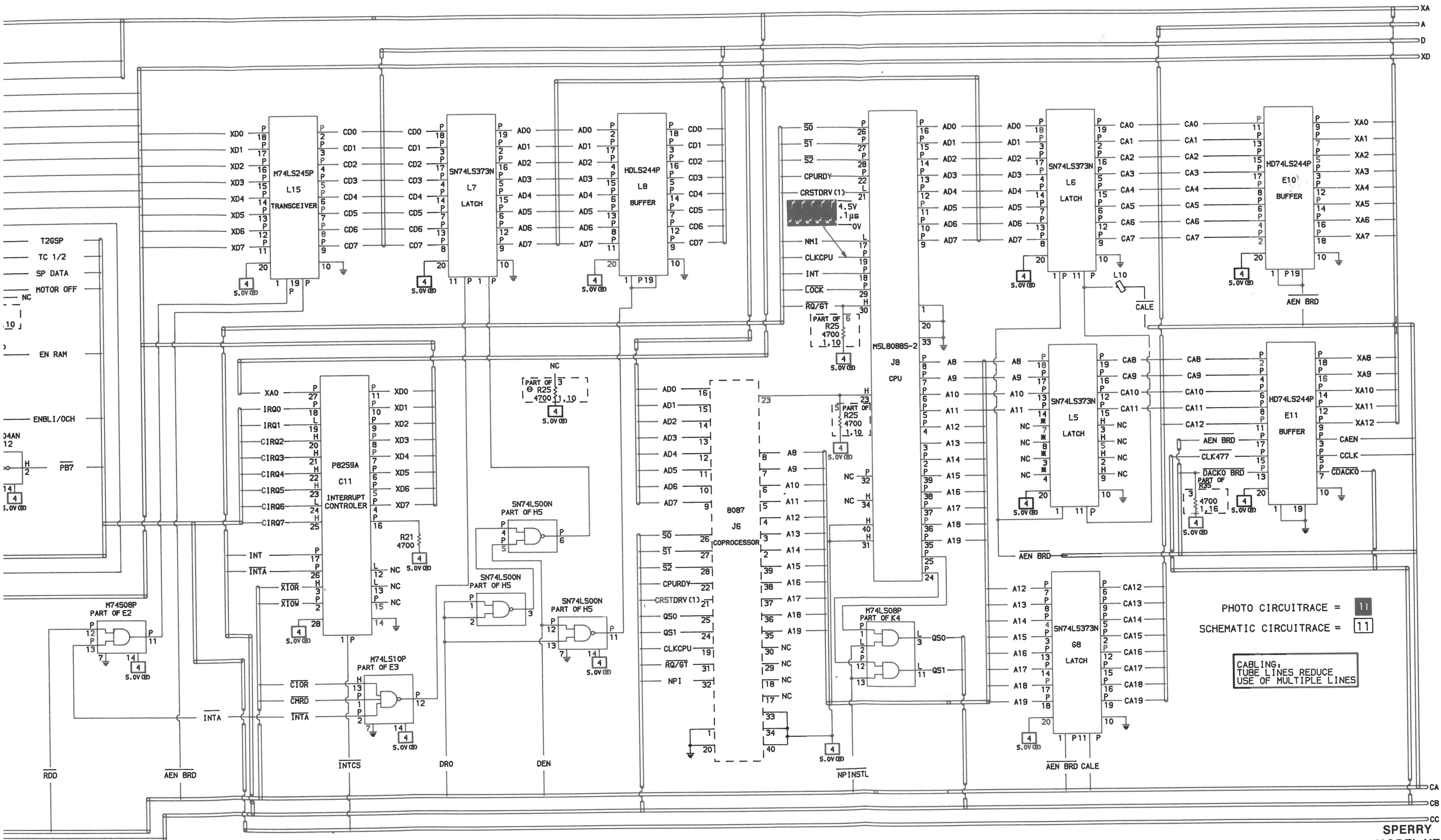


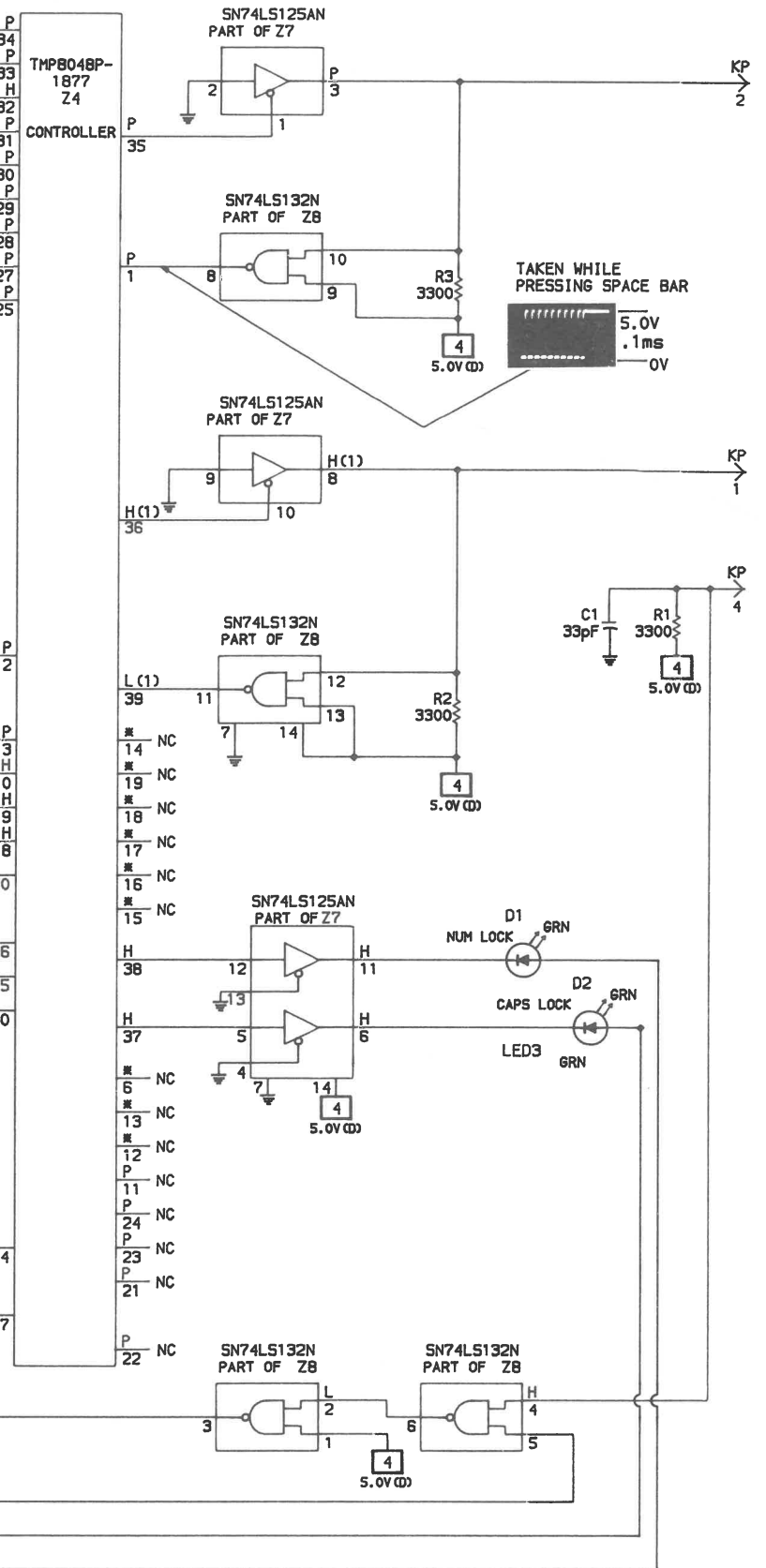
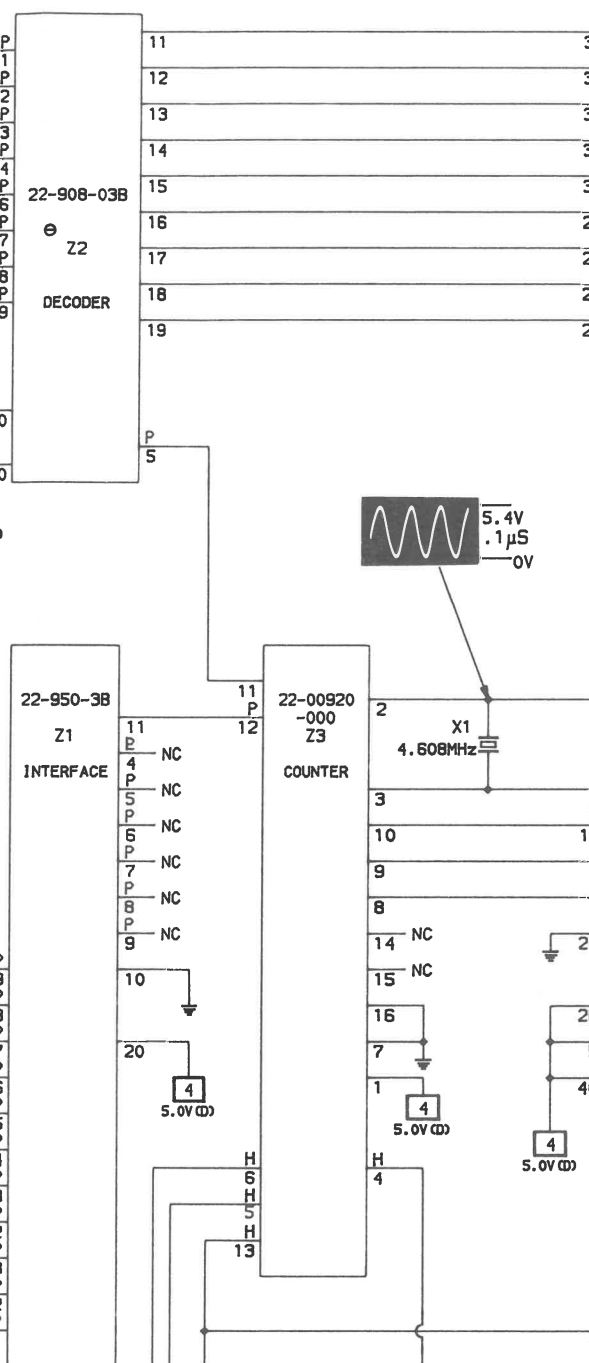
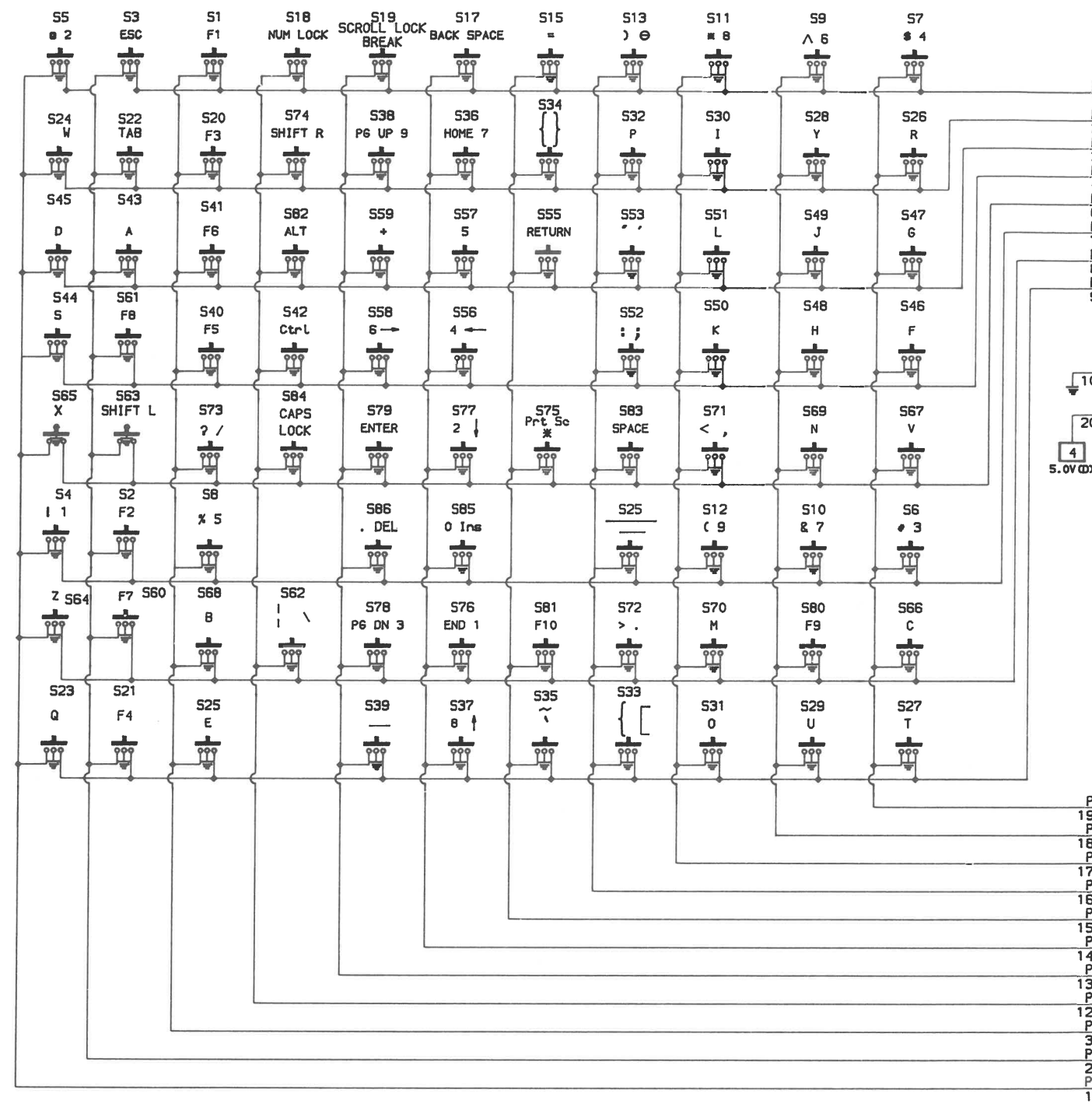
A PHOTOFAC STANDARD NOTATION SCHEMATIC

SYSTEM BOARD

WITH CIRCUITRACE

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TO SYSTEM BOARD

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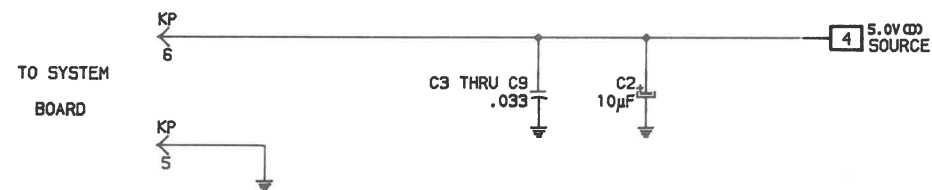
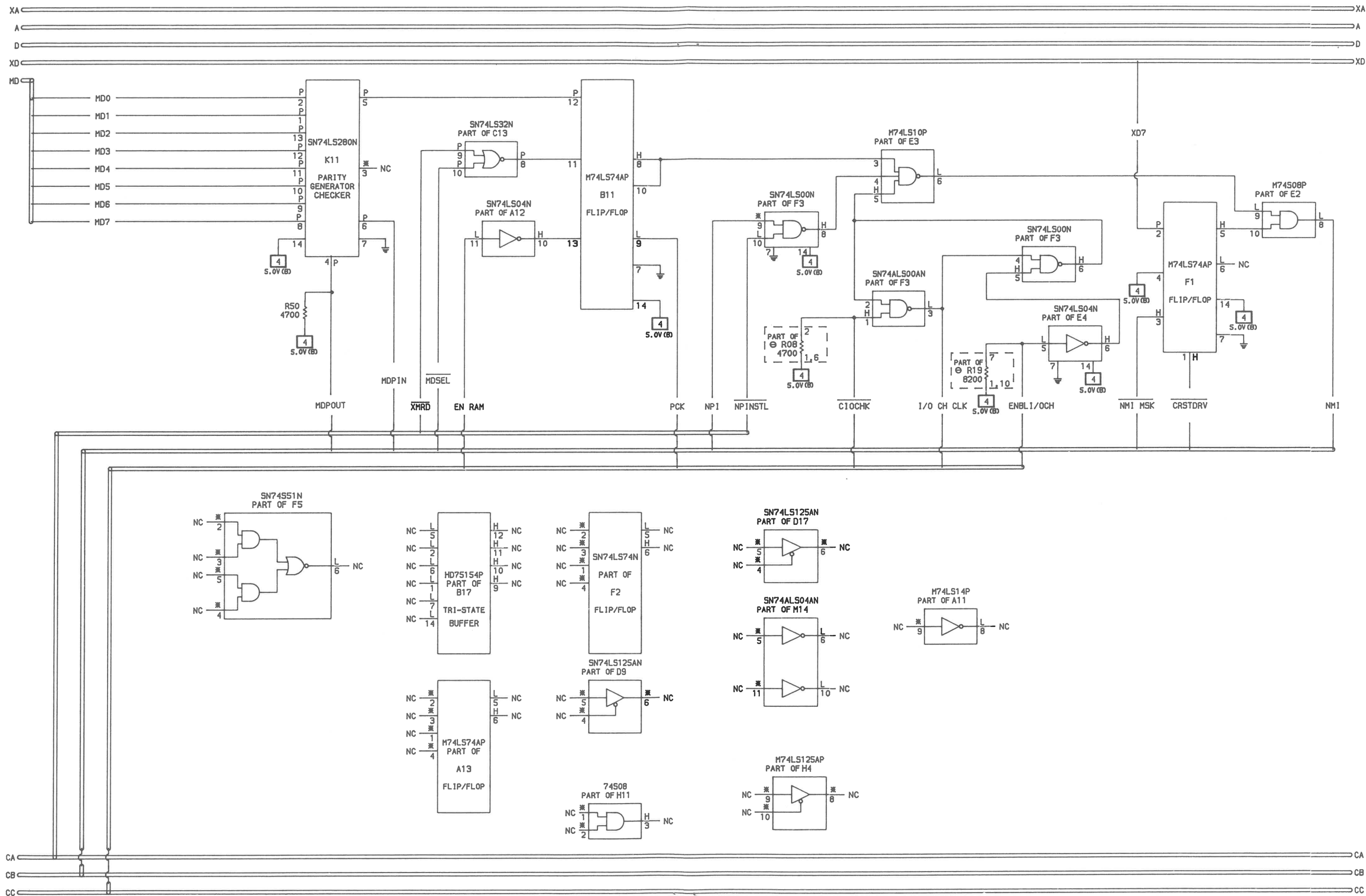


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POWER SUPPLY



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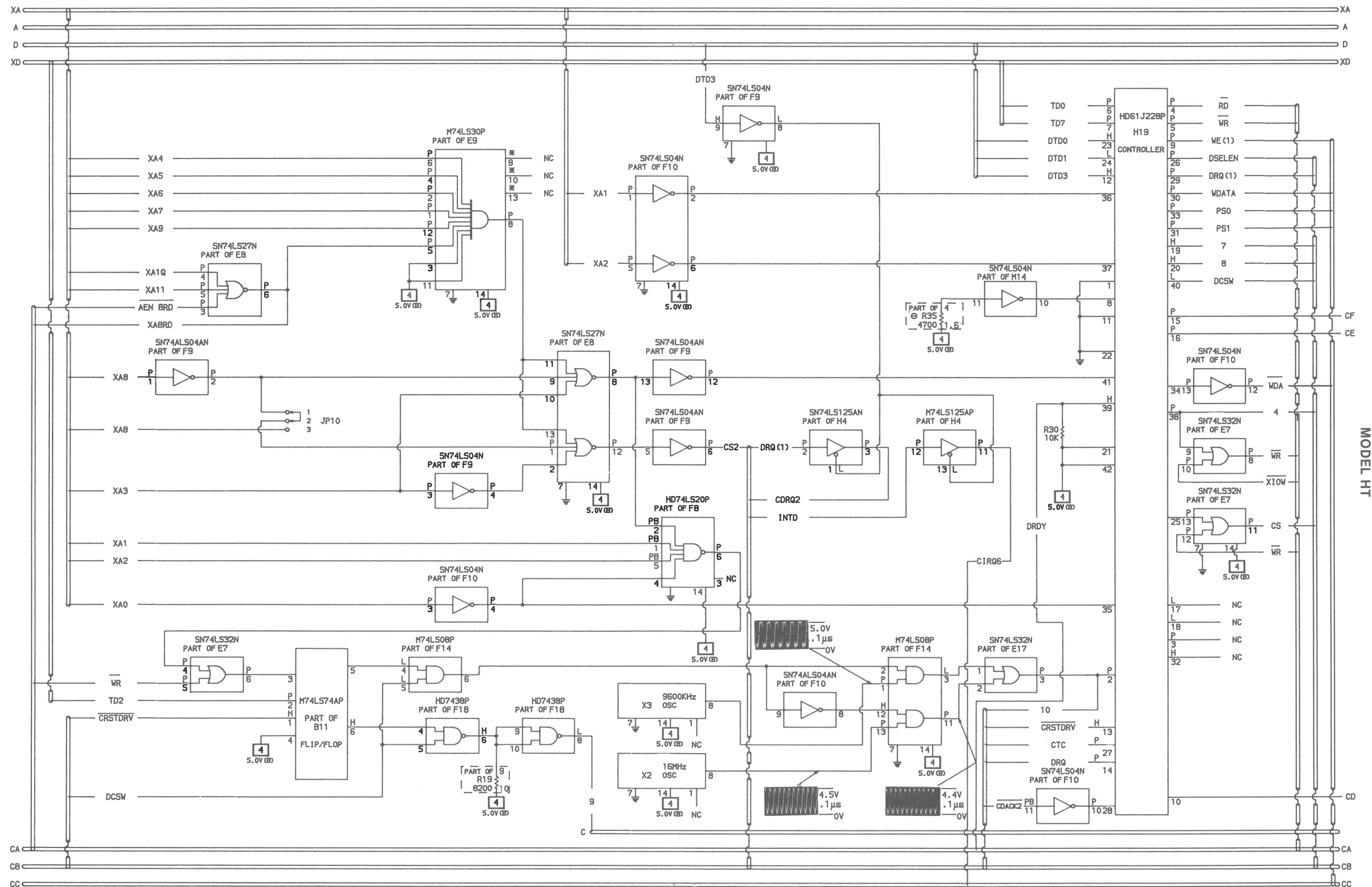
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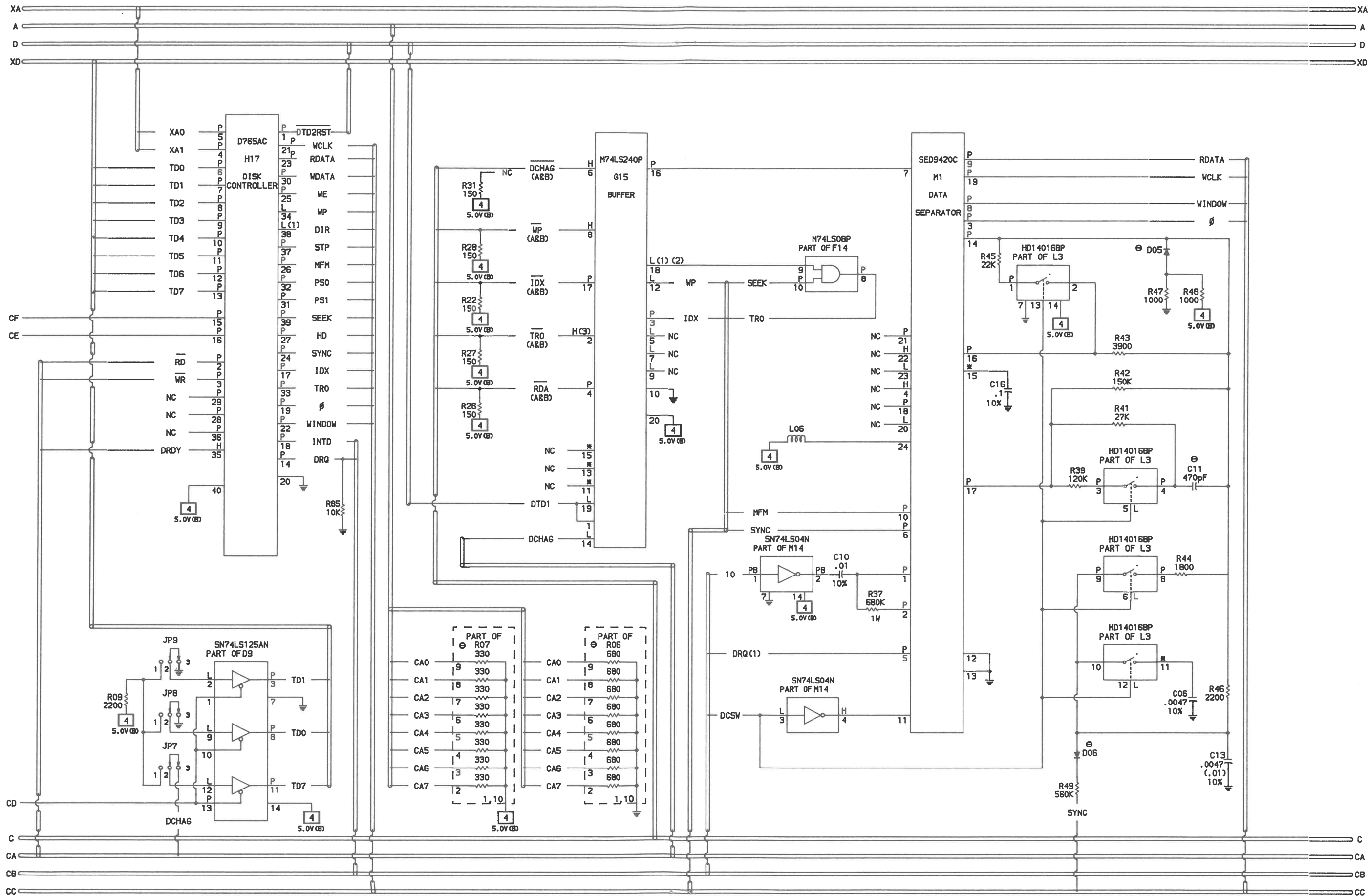
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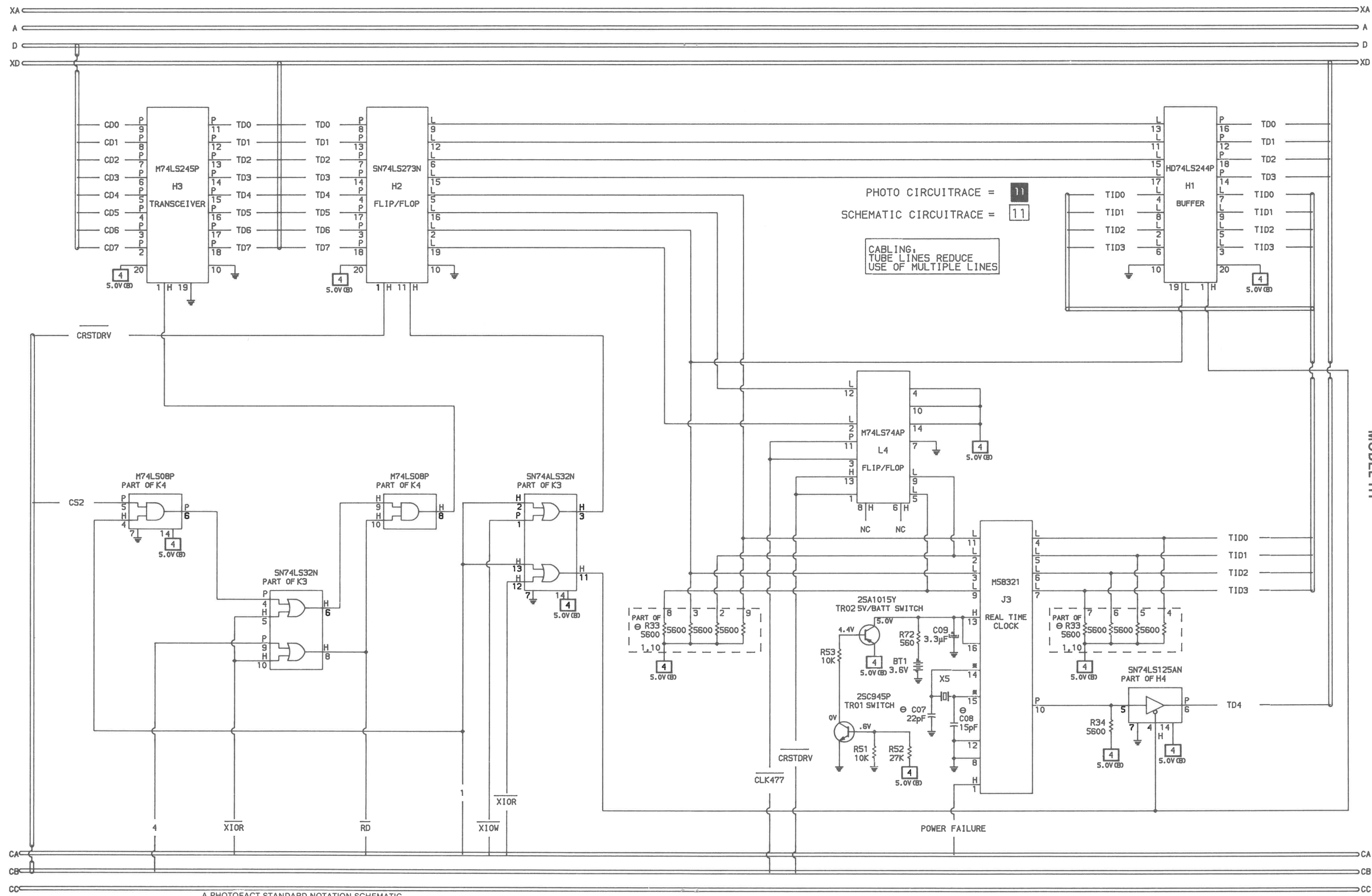


CABLING:
TUBE LINES REDUCE
USE OF MULTIPLE LINES



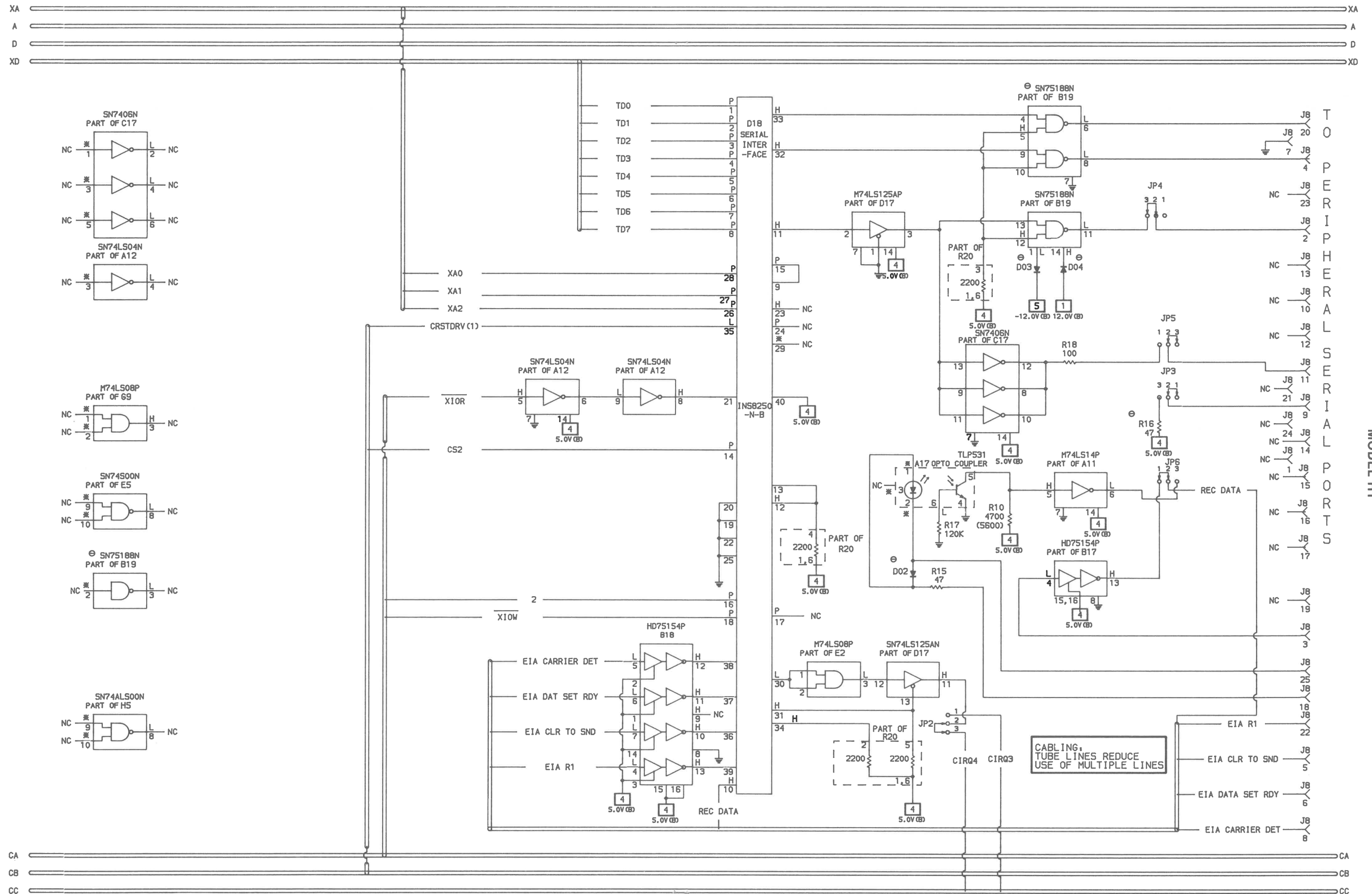
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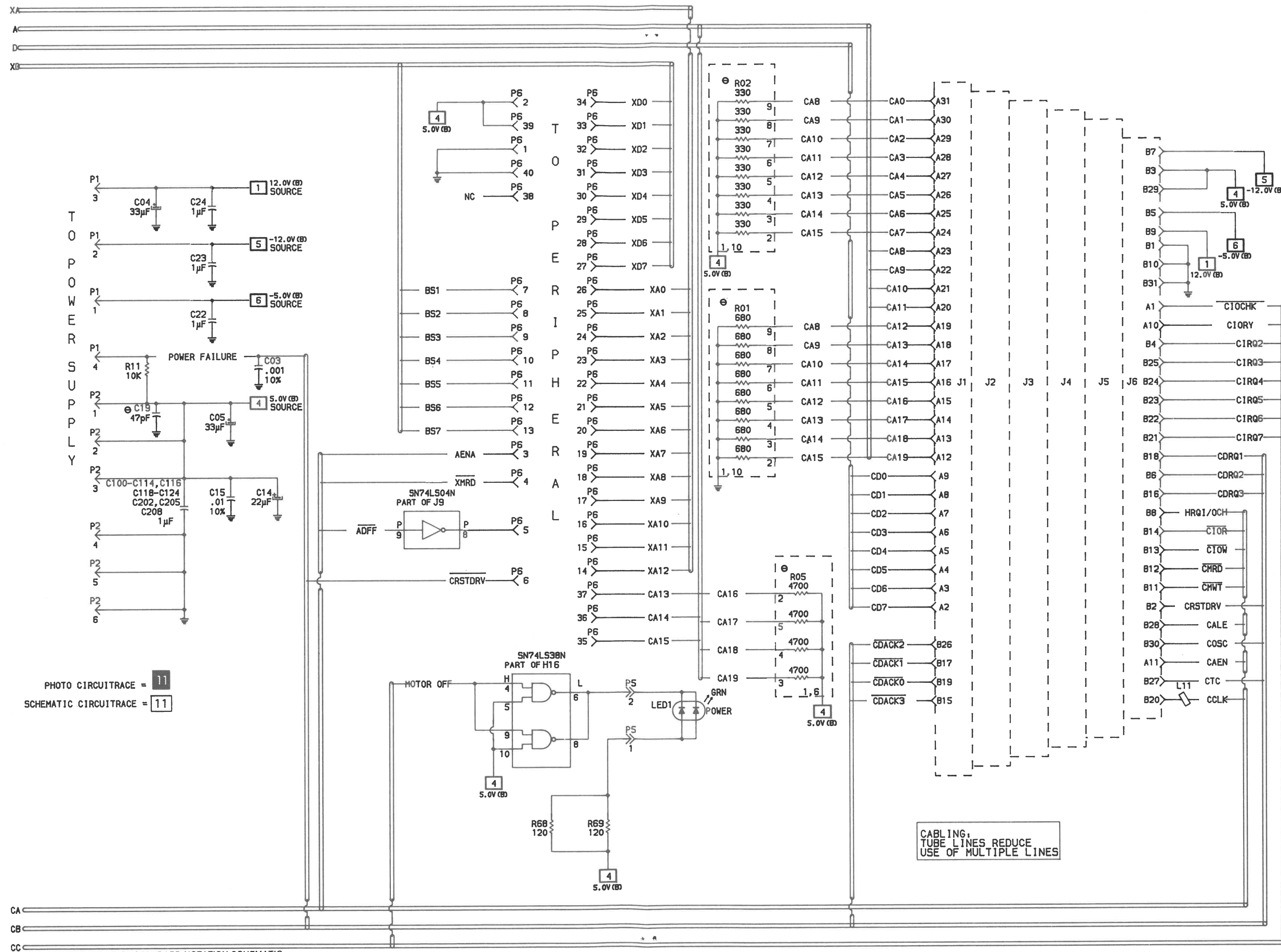
SYSTEM BOARD

A PHOTOFACIT STANDARD NOTATION SCHEMATIC

WITH CIRCUITTRACE

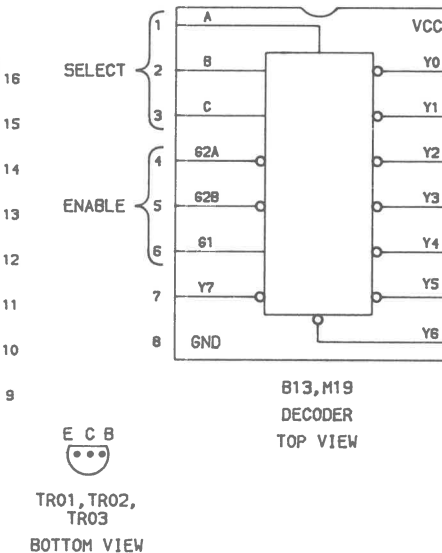
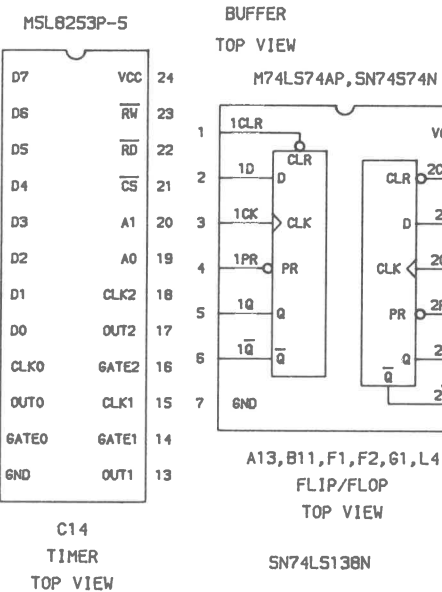
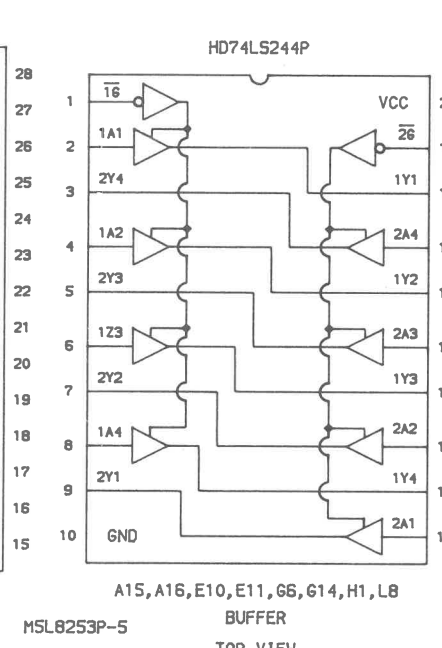
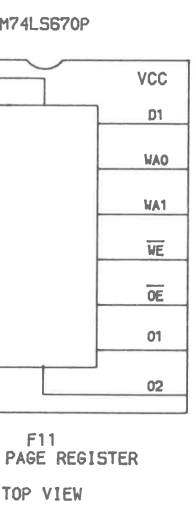
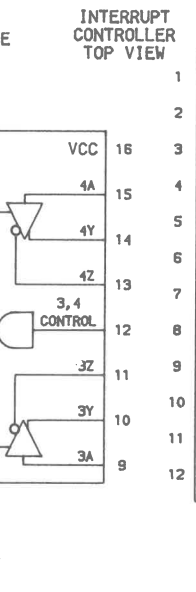
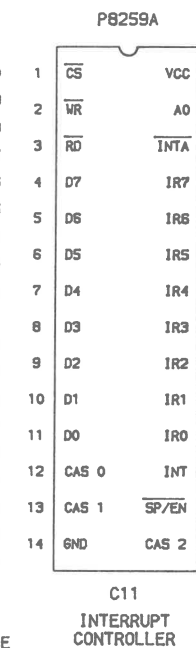
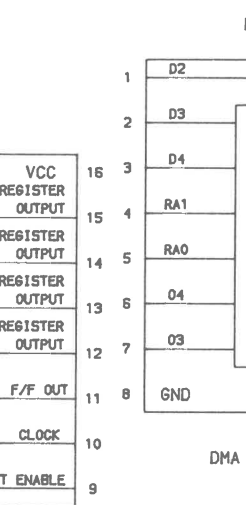
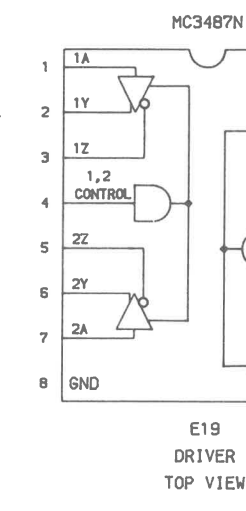
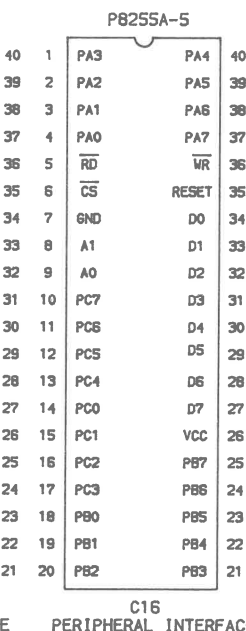
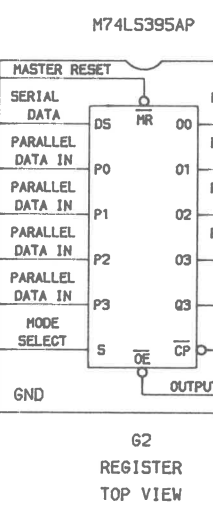
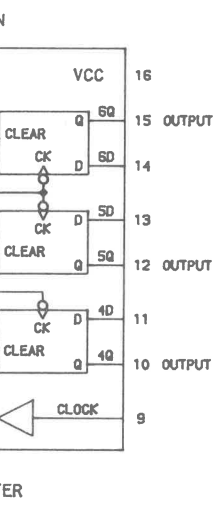
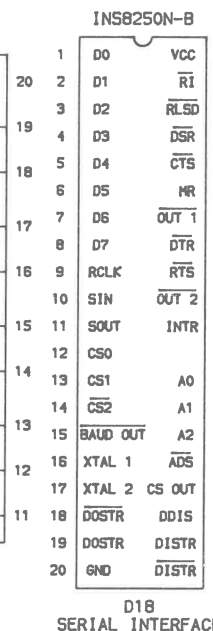
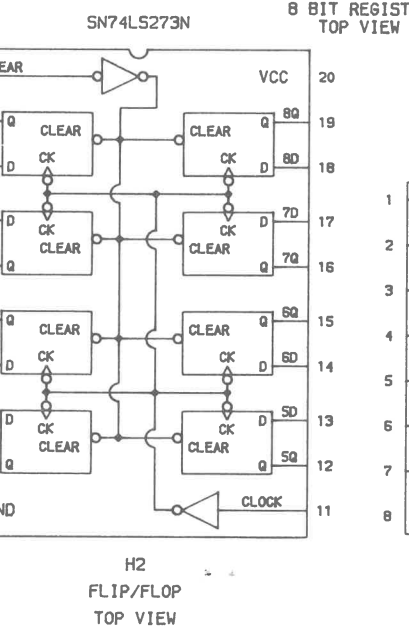
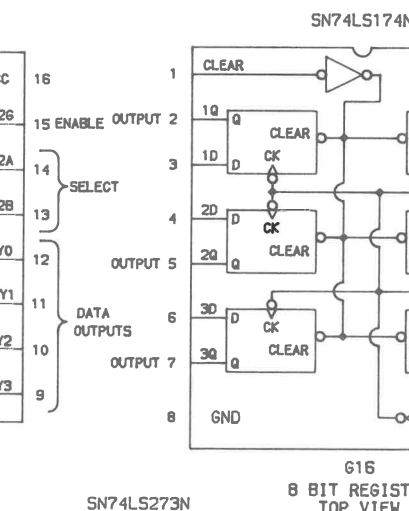
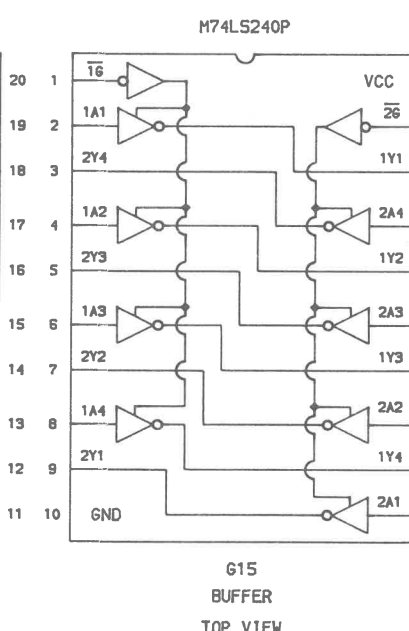
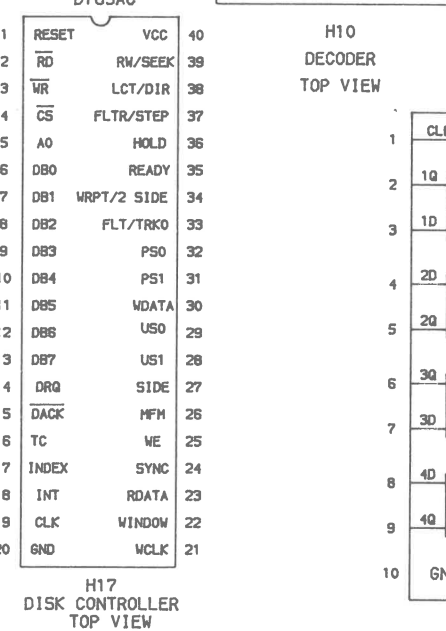
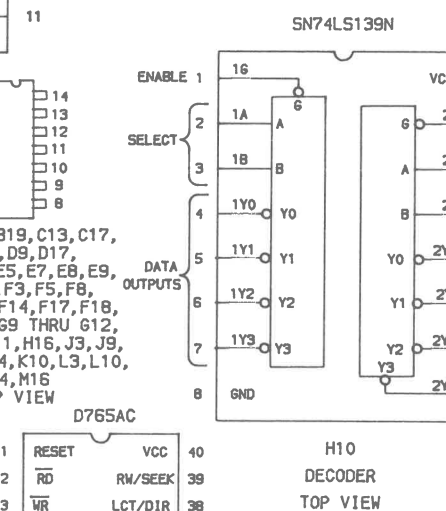
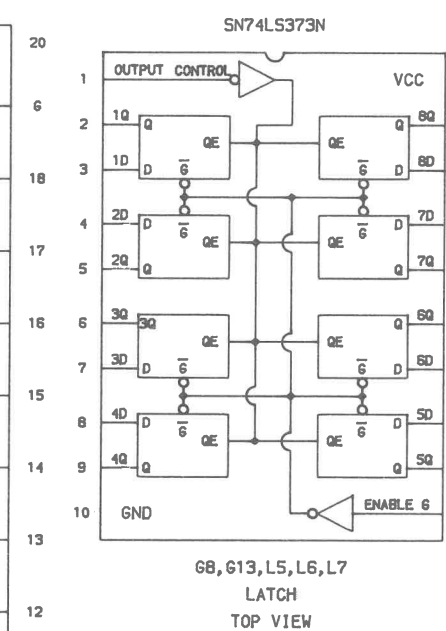
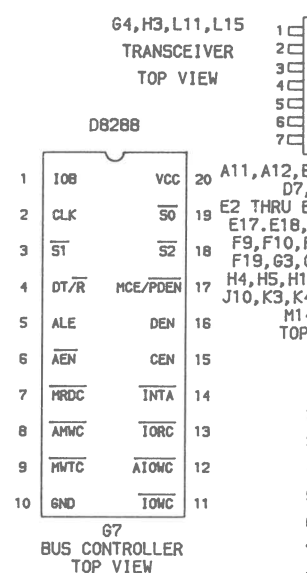
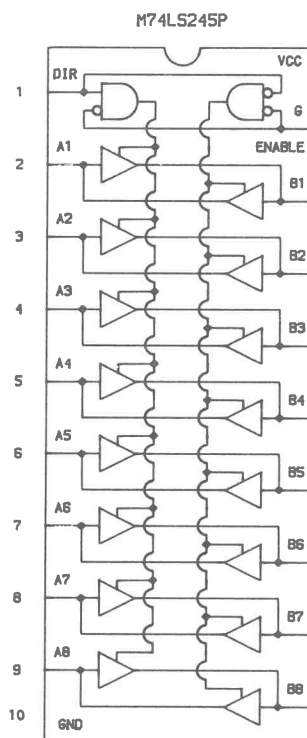
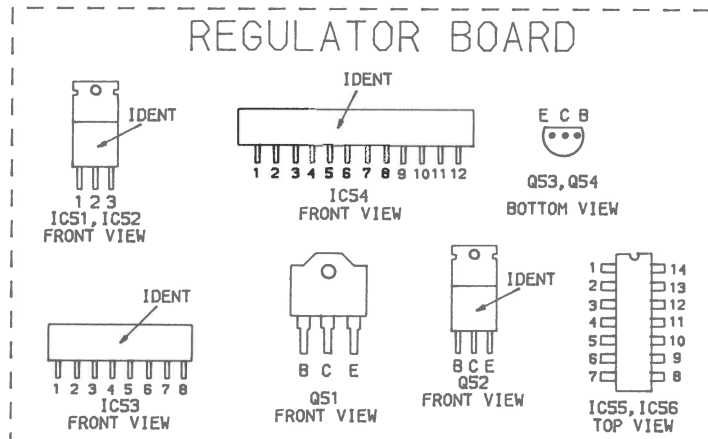
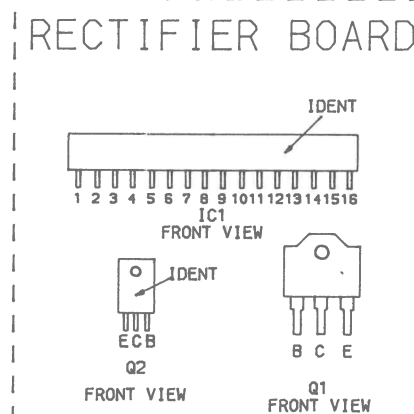
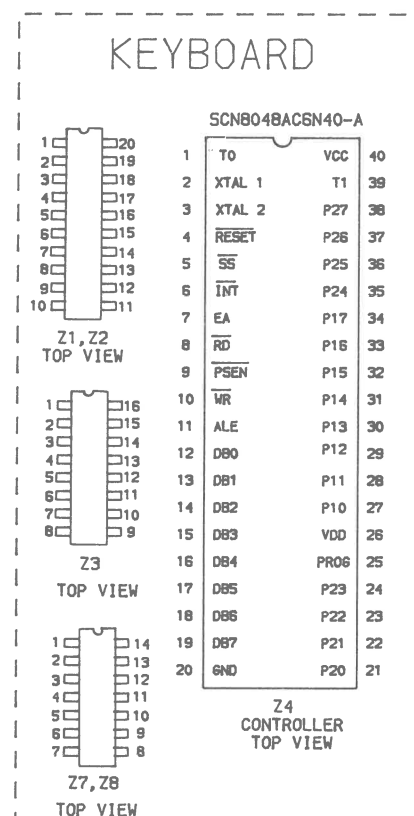
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SYSTEM BOARD

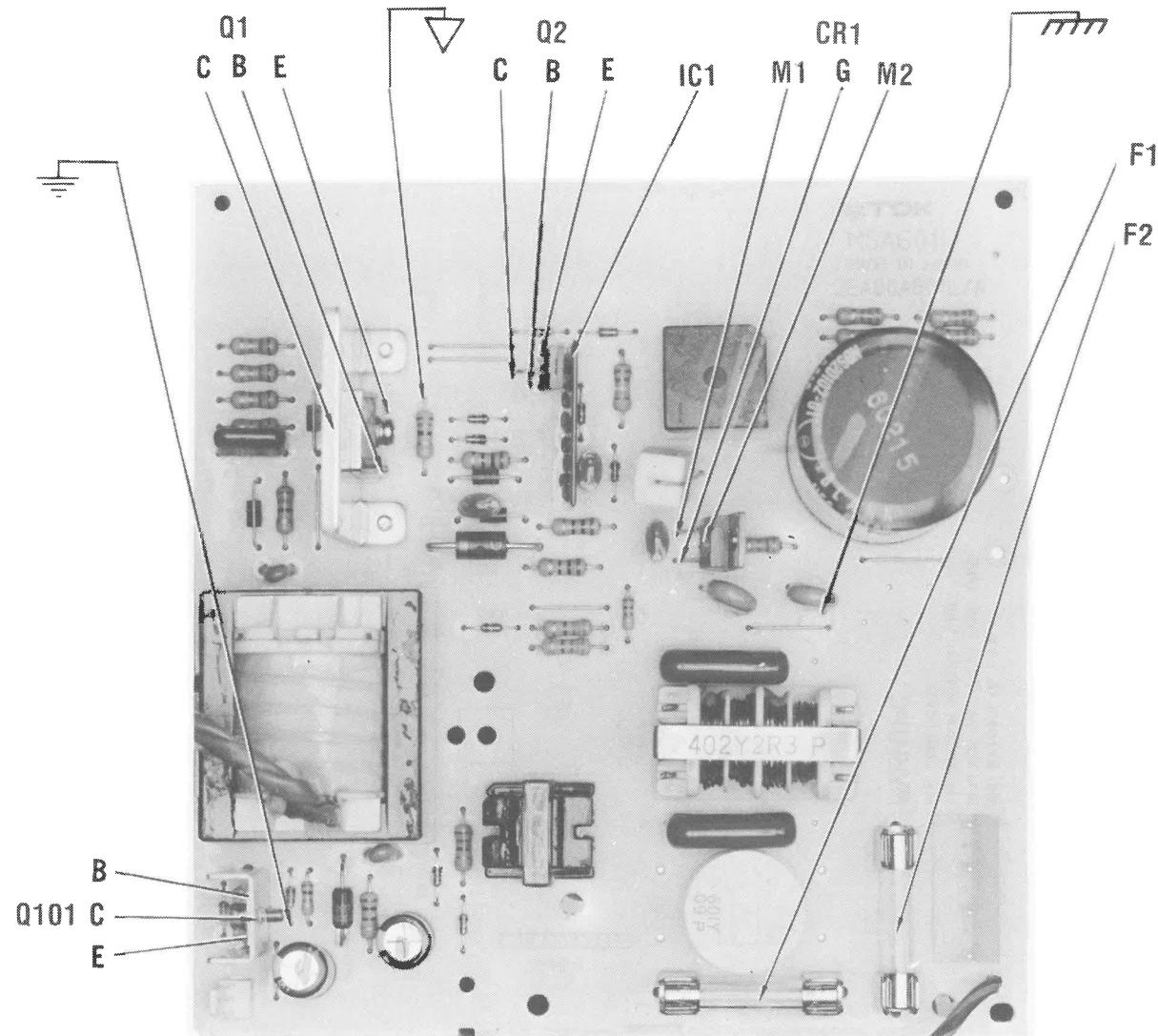


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IC PINOUTS & TERMINAL GUIDES

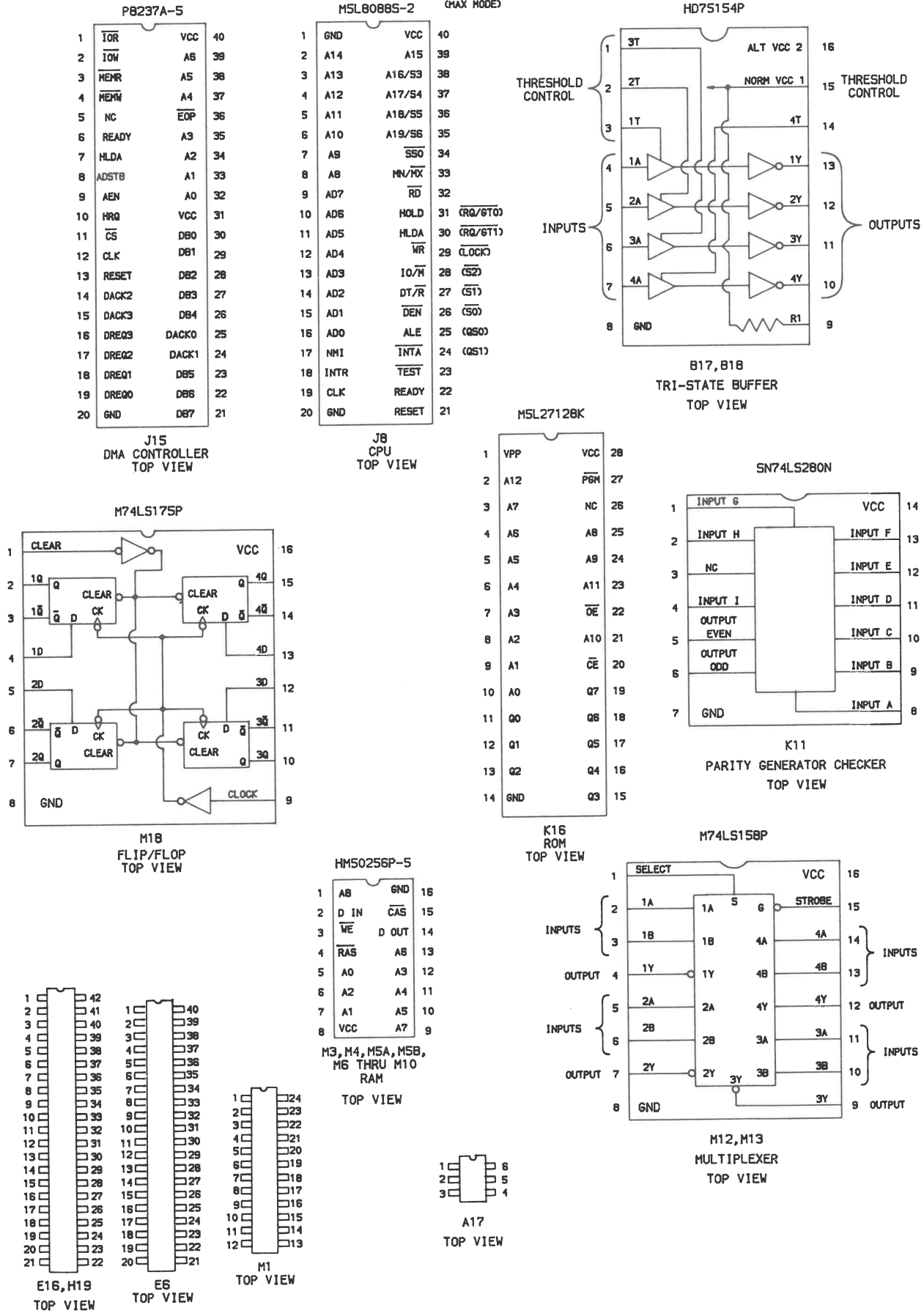


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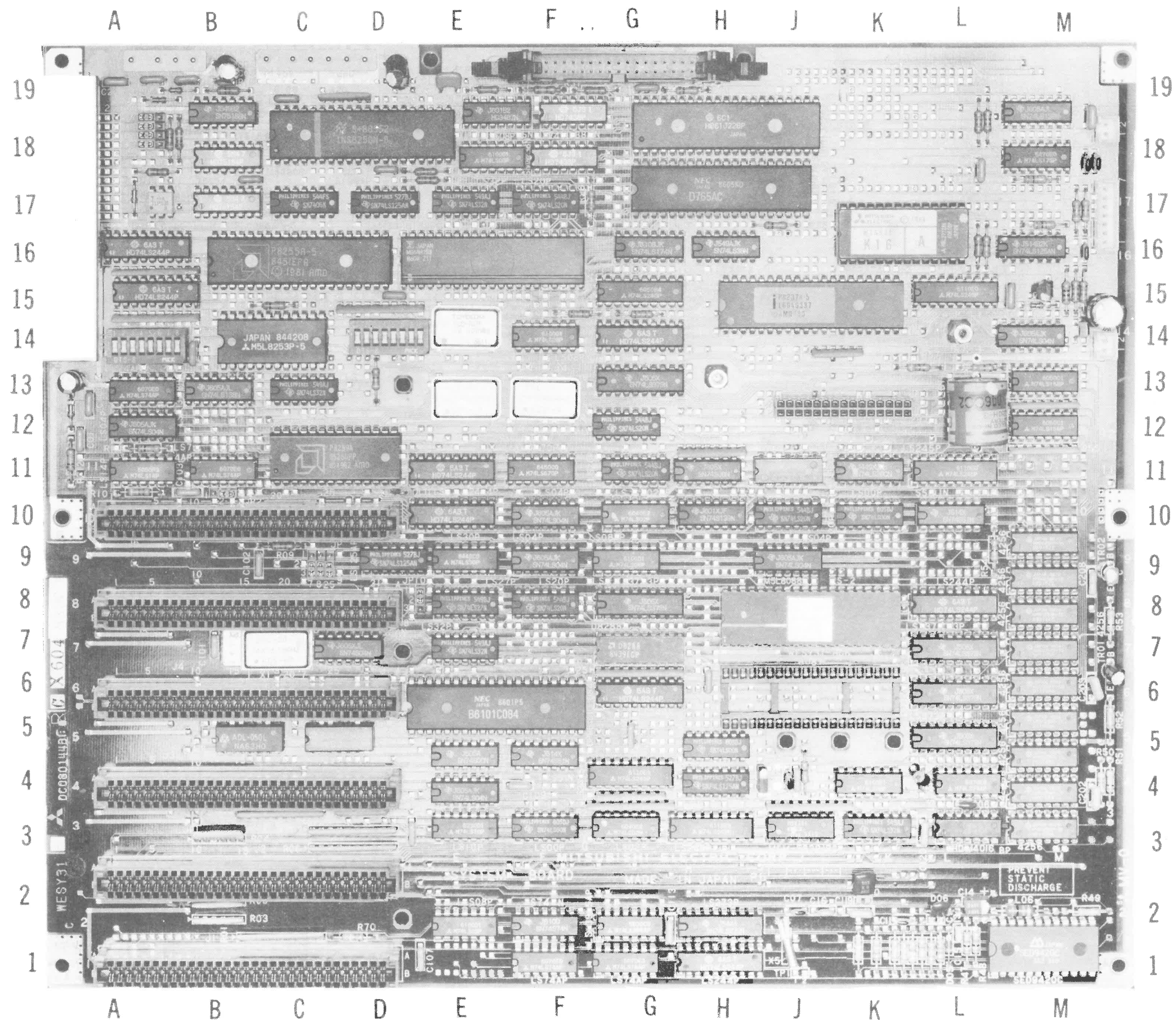


NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

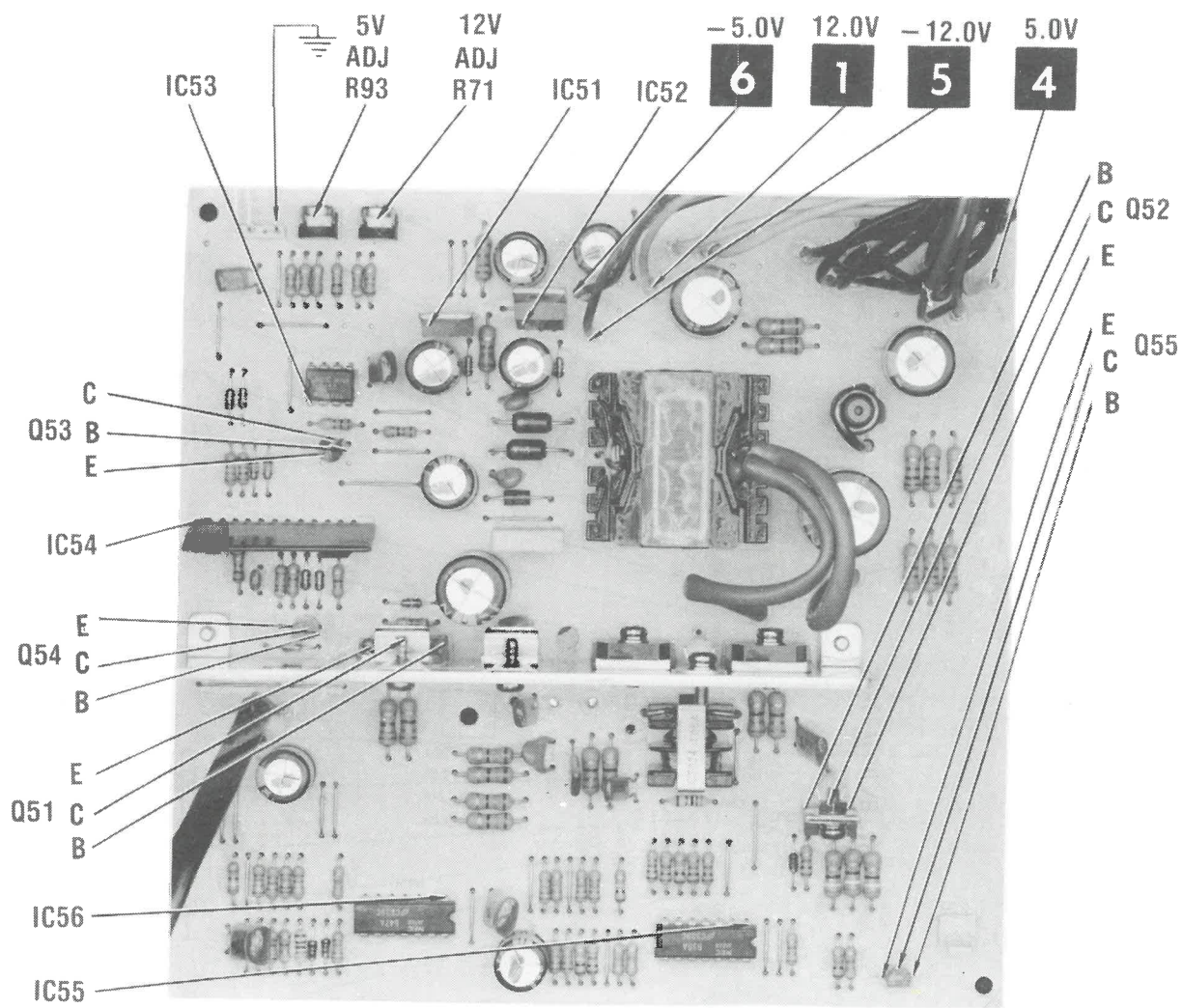
IC PINOUTS & TERMINAL GUIDES



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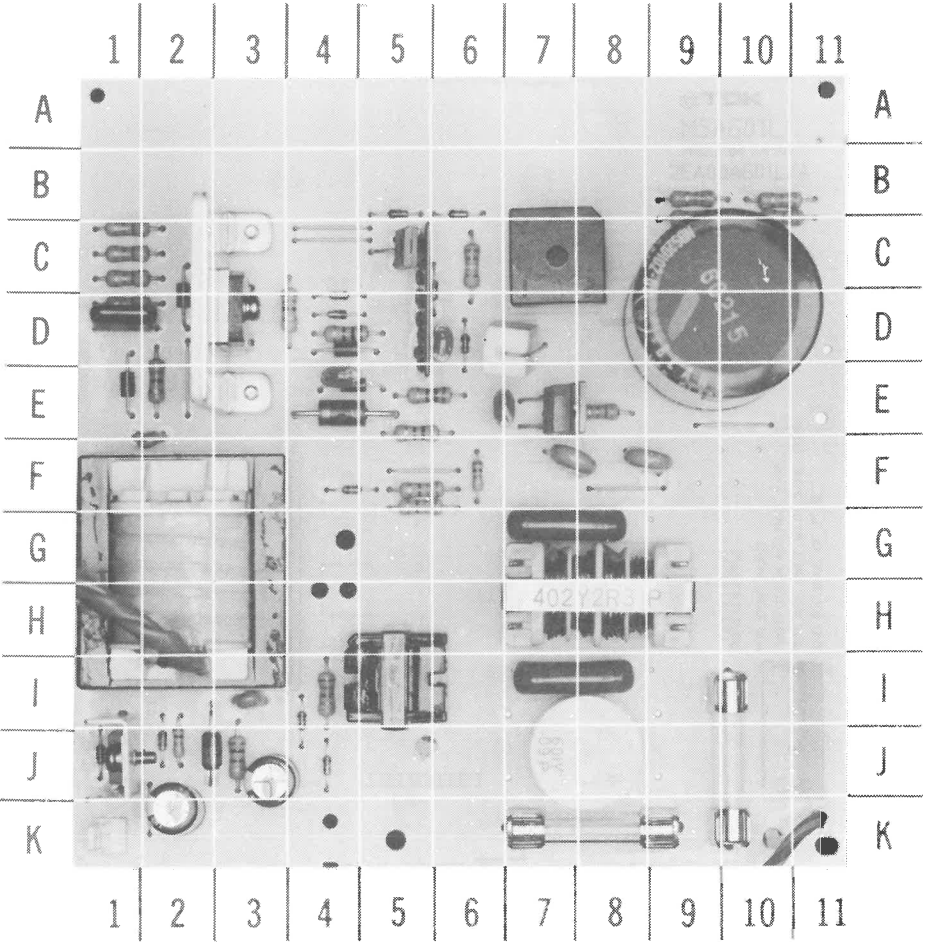
NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

SYSTEM BOARD GridTrace LOCATION GUIDE

BT1	L-12	C14	C-14	L10	L-10	R29	H-12
C01	A-12	C16	C-16	L11	L-11	R30	H-19
C02	A-13	C17	C-17	L15	L-15	R31	G-19
C03	B-19	D7	D-7	M1	M-1	R33	J-4
C04	B-19	D9	D-9	M3	M-3	R34	J-4
C05	D-19	D17	D-17	M4	M-4	R35	J-14
C06	L-4	D18	D-18	M5A	M-5	R37	K-1
C07	J-2	E2	E-2	M5B	M-5	R39	K-1
C08	J-4	E3	E-3	M6	M-6	R41	K-1
C09	J-4	E4	E-4	M7	M-7	R42	K-1
C10	K-2	E5	E-5	M8	M-8	R43	K-1
C11	K-2	E6	E-6	M9	M-9	R44	L-1
C13	L-2	E7	E-7	N10	M-10	R45	L-1
C14	L-2	E8	E-8	M12	M-12	R46	L-1
C15	L-2	E9	E-9	M13	M-13	R48	L-1
C16	J-2	E10	E-10	M14	M-14	R49	M-2
C17	M-14	E11	E-11	M16	M-16	R50	M-4
C18	M-15	E16	E-16	M18	M-18	R51	M-4
C19	M-16	E17	E-17	M19	M-19	R52	M-5
C20	M-18	E18	E-18	J1	B-1	R53	M-8
C21	M-18	E19	E-19	J2	B-2	R54	L-9
C22	A-19	F1	F-1	J3	B-4	R55	M-12
C23	A-19	F2	F-2	J4	B-6	R56	M-13
C24	B-19	F3	F-3	J5	B-8	R57	L-13
C100	A-13	F5	F-5	J6	B-10	R58	M-15
C101	B-7	F8	F-8	J8	A-16	R59	M-15
C102	B-9	F9	F-9	JP1	B-3	R60	M-15
C103	B-11	F10	F-10	JP2	B-11	R61	L-16
C104	B-14	F11	F-11	JP3	A-18	R62	L-16
C105	B-18	F14	F-14	JP4	A-18	R63	M-17
C106	C-19	F17	F-17	JP5	A-18	R64	M-17
C107	E-1	F18	F-18	JP6	A-19	R68	L-19
C108	D-3	F19	F-19	JP7	C-9	R69	L-19
C109	F-4	G1	G-1	JP8	C-9	R70	D-2
C110	D-15	G2	G-2	JP9	C-9	R71	F-19
C111	D-18	G3	G-3	JP10	D-8	R72	L-13
C112	E-19	G4	G-4	L06	M-2	R75	A-15
C113	G-2	G6	G-6	L10	L-4	R76	M-17
C114	G-5	G7	G-7	L11	D-11	R77	M-18
C116	H-6	G8	G-8	P1	A-19	R78	E-18
C118	G-19	G9	G-9	P2	C-19	R79	E-18
C119	K-2	G10	G-10	P3	M-17	R85	J-17
C120	L-3	G11	G-11	P4	M-14	SW1	A-14
C121	J-4	G12	G-12	P5	M-18	SW2	D-14
C122	M-15	G13	G-13	P7	J-13	SW3	A-15
C123	L-18	G14	G-14	P8	G-19	TR01	M-6
C124	M-19	G15	G-15	R01	C-2	TR02	M-9
C202	M-4	G16	G-16	R02	C-4	TR03	M-15
C205	M-6	H1	H-1	R03	B-2	X1	C-7
C208	M-9	H2	H-2	R04	B-3	X2	E-14
D01	A-12	H3	H-3	R05	B-2	X3	E-13
D02	A-17	H4	H-4	R06	D-3	X4	F-13
D03	A-19	H5	H-5	R07	D-3	X5	J-1
D04	A-19	H10	H-10	R08	D-4		
D05	L-1	H11	H-11	R09	C-9		
D06	L-2	H16	H-16	R10	A-11		
D07	M-15	H17	H-17	R11	A-12		
DL1	C-5	H19	H-19	R12	A-11		
DL2	B-5	J3	J-3	R13	A-15		
DL3	J-11	J8	J-8	R14	A-16		
IC'S		J9	J-9	R15	A-18		
A11	A-11	J10	J-10	R16	A-18		
A12	A-12	J15	J-15	R17	B-18		
A13	A-13	K3	K-3	R18	B-19		
A15	A-15	K4	K-4	R19	D-15		
A16	A-16	K10	K-10	R20	C-19		
A17	A-17	K11	K-11	R21	D-13		
B11	B-11	K16	K-16	R22	E-19		
B13	B-13	L3	L-3	R23	G-4		
B17	B-17	L4	L-4	R24	G-4		
B18	B-18	L5	L-5	R25	G-6		
B19	B-19	L6	L-6	R26	F-17		
C11	C-11	L7	L-7	R27	F-15		
C13	C-13	L8	L-8	R28	G-15		

RECTIFIER BOARD
GridTrace LOCATION GUIDE

C1	I-7
C2	G-7
C3	F-7
C4	F-9
C5	E-7
C6	D-10
C7	D-1
C8	E-2
C9	C-6
C10	E-4
C101	I-3
C102	K-2
C103	J-3
CP1	I-11
CP101	K-1
CR1	E-7
CR2	C-7
CR3	F-4
CR4	D-2
CR5	E-1
CR6	B-5
CR7	B-6
CR8	C-6
CR9	E-4
CR10	D-4
CR11	D-4
CR12	D-4
CR13	E-4
CR14	C-6
CR101	J-2
CR102	J-1
CR103	J-2
CR104	I-4
CR105	J-4
F1	K-8
F2	J-10
IC1	C-5
L1	J-8
L2	H-7
Q1	D-3
Q2	C-5
R1	E-8
R2	C-6
R3	F-6
R4	F-5
R5	F-5
R6	B-9
R7	B-10
R8	B-9
R9	B-10
R10	C-1
R11	C-1
R12	C-1
R13	D-1
R14	E-2
R15	D-4
R16	C-6
R17	D-4
R18	E-5
R19	E-5
R501	J-3
R502	J-2
R503	I-4
T1	G-2
T2	I-5



GENERAL OPERATING INSTRUCTIONS

SELF-TEST

A Self-Test is automatically performed each time Computer is turned On when Switch 5 of Dip Switch SW3 is set Off. If no problem is found, Computer will beep once and start booting from a diskette inserted in Disk Drive A. If a problem is found, a series of beeps may be heard or an error message may be displayed on Monitor screen.

Beeps		
Long	Short	
0	0	Defective Timer or DMA circuit
1	1	Defective Memory circuit
1	2	Defective Interrupt Controller circuit
1	3	Defective Timer Interrupt circuit
1	4	Keyboard not connected or defective Keyboard circuit
1	5	Defective video RAM on CRT Controller Board
1	6	Defective CRT Controller Board.

BOOT UP

Insert a bootable diskette into Disk Drive A and turn On Computer. The Computer will automatically boot up using diskette in Disk Drive A. If a MS-DOS (Microsoft Disk Operating System) diskette is used, Computer will display date and time and ask for a new date and time. After date and time have been entered, the version of DOS will be displayed on Monitor screen along with an A> which indicates DOS is running.

MS-DOS

For a list of file names on the diskette in current Disk Drive, type DIR and press ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B.

To return to MS-DOS from Basic, type SYSTEM and press ENTER key.

To load a (System) program from a diskette while in DOS, type program name and press ENTER key.

USING BLANK DISKETTES

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press ENTER key. Follow instructions on Monitor screen to format unformatted diskette.

NOTE: Formatting a diskette will wipe out any programs previously placed on diskette. The Computer automatically defaults to Disk Drive A if destination Disk Drive is not specified. Be sure to specify destination Disk Drive of diskette to be formatted or original diskette may be ruined by default action.

BASIC

When turned On, Computer will come up in MS-DOS as long as MS-DOS diskette is in Drive A. The version of MS-DOS will appear at the top of the screen.

The manufacturer also supplies Disk Basic on diskette. To load Disk Basic, first boot up DOS. Insert a diskette with Disk Basic program on it. Type BASIC and press RETURN key or type BASICA and press RETURN key to load Disk Basic. To return to DOS from Basic, type SYSTEM and press ENTER key.

To view a list and names of programs on a diskette in the current Drive, type FILES and press ENTER key. Type FILES "B: *.*" and press ENTER key to list programs from Disk Drive B. Type FILES "A: *.*" to list programs from Disk Drive A if it is not the current (default) drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, program name enclosed in quotes and press ENTER key.

To save a program, type SAVE, program name enclosed in quotes and press ENTER key.

To run a program from any Basic mode, type RUN and press ENTER key. To stop a program, press CTRL and BREAK (SCROLL LOCK) keys at the same time.

NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping program while it is running.

RESETTING COMPUTER

Press CTRL, ALT and DEL keys all three at the same time to reset Computer.

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SWITCHES AND JUMPERS

SYSTEM BOARD

There are three DIP switches (SW1, SW2, SW3) located on System Board. SW1 and SW2 must be set according to the number of Disk Drives, type of Monitor Adaptor and amount of RAM memory available. Set SW3 to desired operating modes. Use the following charts to determine the correct Switch settings.

The following switches must be Off:

	SW1	1,3,4	
	SW2	5,6,7,8	
Number of 5-1/4" Drives	SW1 On	SW1 Off	
1	7,8		
2	8	7	
3	7	8	
4		7,8	
RAM	SW1 On	SW2 Off	
Less than 640K	2		
With 640K		2	
Monitor Adapter	SW1 On	SW1 Off	
None or Enhanced Graphics Display used	5,6		
Color Controller Board (40x25)	6	5	
Color Controller Board (80x25)	5	6	
Monochrome		5,6	
SW2	SW2 On	SW2 Off	
On Board 256K	1,4	2,3	
Expansion 384K	1,3	2,4	
Expansion 512K	1	2,3,4	
Expansion 640K	1,3,4	2	
SW3	SW3 On	SW3 Off	
7.16MHz Clock	8		
4.77MHz Clock		8	
8087 (IC J6) Installed		7	
8087 Not Installed	7		
8087 8MHz Version	6		
8087 5MHz Version		6	
Self-Test On		5	
Self-Test Off	5		
Serial Printer does not use XON/OFF	4		
Serial Printer uses XON/OFF		4	
SW3	SW3 On	SW3 Off	
PC Advanced features enabled (high resolution Color Monitor and RS232 XON/OFF enabled)	3		
PC Advanced features disabled Medium Resolution Monitor or Enhanced Graphics Display used	2	3	
High Resolution Monitor used		2	
Normal Loading	1		
Self-Test repeats		1	

Serial Port Jumpers

Select COM1 Port	Set Jumper JP10 to pins 1 and 2
Select COM2 Port	Set Jumper JP10 to pins 2 and 3
Select Voltage Interface	Set Jumpers JP3 thru JP6 to pins 1 and 2
Select Current Interface	Set Jumpers JP3 thru JP6 to pins 2 and 3
Enable IRQ3 from Serial Port	Set Jumper JP2 to pins 1 and 2
Enable IRQ4 from Serial Port	Set Jumper JP2 to pins 2 and 3

MONOCHROME TEXT CONTROLLER

Standard Character Set

Jumpers must be installed on the following pins for Standard Character Set:

E2	to E4
E27	to E28
E5	to E6
E9	to E11

Printer Port

Printer port can be configured to one of three addresses by setting jumpers as follows:

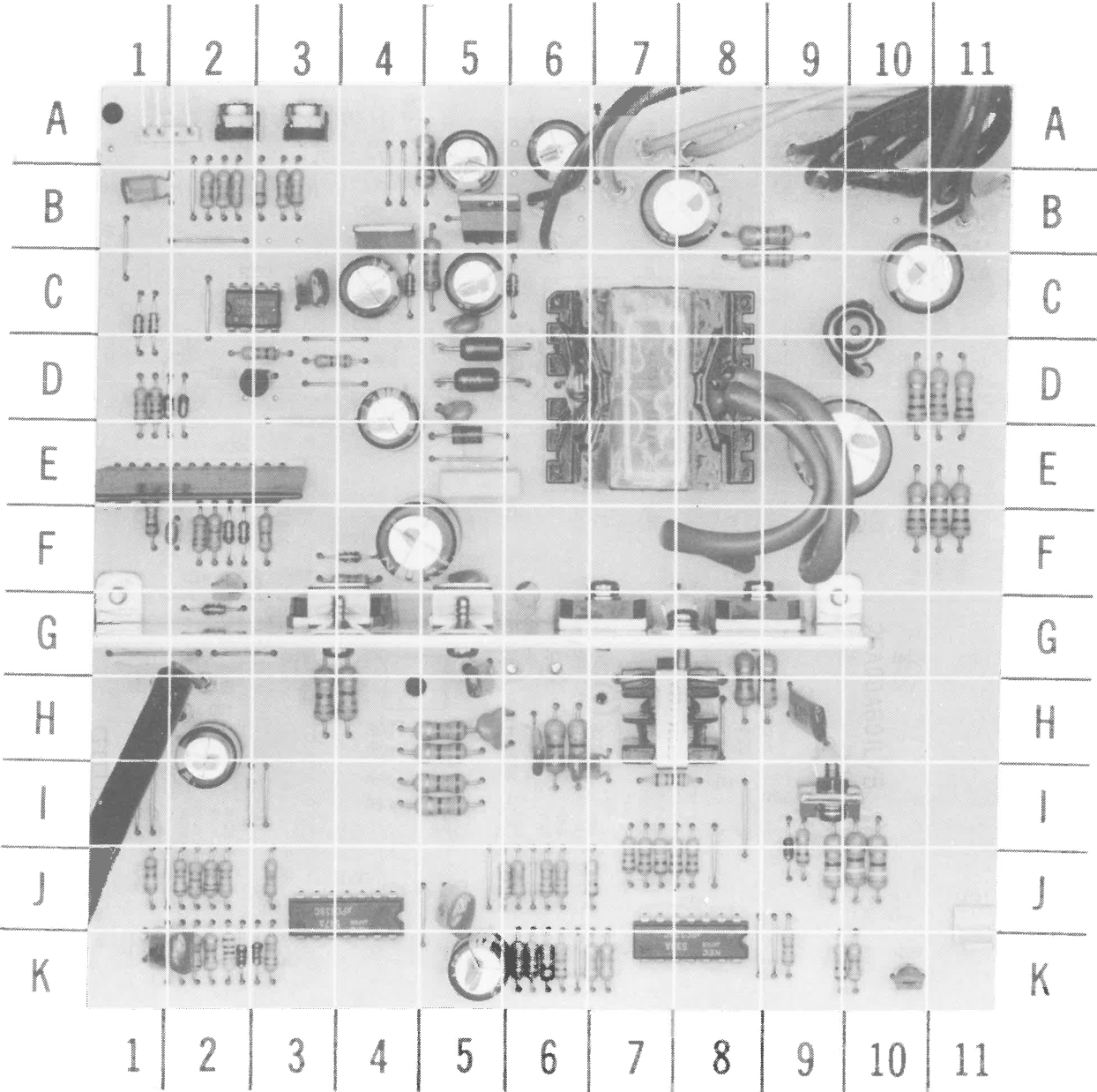
Address 3BC to 3BE (Printer 1, LPT1)	E12 to E14, E17 to E19
Address 378 to 37A (Printer 2, LPT2)	E12 to E14, E15 to E17
Address 278 to 27A (Printer 3, LPT3)	E10 to E12, E17 to E19

The following jumpers are also used to control printer port operation:

Printer Interface	E16 to E18
Disable Direction Control	E21 to E23, E22 to E24
Enable Interrupt Level 7	E32 to E33 (Remove Jumper from E30 to E31)
Enable Interrupt Level 5	E30 to E31 (Remove Jumper from E32 to E33)

REGULATOR BOARD GridTrace LOCATION GUIDE

C51	D-4	R65	D-1
C52	D-5	R66	C-1
C53	C-4	R67	D-2
C54	A-6	R68	D-3
C55	C-5	R69	B-2
C56	C-5	R70	B-2
C57	A-5	R71	A-2
C58	H-5	R72	B-2
C59	F-5	R73	H-6
C60	H-5	R74	H-6
C61	F-4	R75	H-9
C62	B-8	R76	H-8
C63	B-1	R77	D-11
C64	C-3	R78	D-11
C65	H-6	R79	D-10
C66	H-9	R80	F-11
C67	E-9	R81	F-11
C68	C-10	R82	F-10
C69	I-7	R83	I-7
C70	A-10	R84	J-1
C71	H-2	R85	F-2
C72	K-1	R86	F-3
C73	F-2	R87	F-2
C74	J-5	R88	F-1
C75	K-5	R89	D-1
COM	A-2	R90	D-1
CP51	J-11	R91	B-3
CR51	E-5	R92	B-3
CR52	D-5	R93	A-3
CR53	C-4	R94	B-3
CR54	D-5	R95	K-10
CR55	C-6	R96	K-10
CR56	G-5	R97	K-9
CR57	F-4	R98	J-7
CR58	J-9	R99	J-6
CR59	G-7	R100	K-7
CR60	G-8	R101	J-6
CR61	K-2	R102	J-6
CR62	F-2	R103	K-6
CR63	F-2	R104	J-7
CR64	G-2	R105	J-6
CR65	D-1	R106	K-7
CR66	C-1	R107	K-6
CR67	D-2	R108	G-8
CR68	C-1	R109	J-7
CR69	K-3	R110	J-8
CR70	K-2	R111	K-6
IC51	B-4	R116	J-7
IC52	B-5	R117	J-8
IC53	C-4	R118	I-9
IC54	E-1	R119	K-6
IC55	K-8	R120	K-2
IC56	J-4	R121	J-2
L51	D-7	R122	K-2
L52	C-10	R123	J-2
Q51	G-3	R124	J-2
Q52	I-9	R125	K-2
Q53	D-3	R126	J-2
Q54	F-2	R127	K-2
Q55	K-10	R128	J-3
R51	C-5	R129	K-3
R52	A-5	S	A-1
R53	I-5	T51	H-7
R54	I-5	VCC	A-1
R55	H-5		
R56	H-5		
R57	F-4		
R58	E-5		
R59	J-10		
R60	G-8		
R61	K-2		
R62	F-2		
R63	F-2		
R64	G-2		



TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT (COMPUTERFACTS)

Equipment	B & K Precision Equipment No.	Sencore Equipment No.	Notes
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51,DP21		
LOGIC PULSER	DP101,DP31		
DIGITAL VOM	2830,2806	DVM37,DVM56,SC61	
ANALOG VOM	277,111,116		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1251,1260,1249	CG25,VA62	
RGB GENERATOR	1260,1249		
FUNCTION GENERATOR	3020,3011,3030		
HI-VOLTAGE PROBE	HV-44	HP200	
VOM/DMM			
Accessory probes	PR-28(HV)		
TEMPERATURE PROBE	TP-28,TP-30		
CRT ANALYZER	467,470	CR70	
DIGITAL IC TESTER	560,550,552		
CAPACITANCE ANALYZER		LC53,LC75,LC76 LC77	
INDUCTANCE ANALYZER		LC53,LC75,LC76 LC77	

CSCS20

SPERRY
MODEL HT

TROUBLESHOOTING

POWER SUPPLY

NOTE: Use an Isolation transformer with a step down control when servicing power supply. Disconnect power supply from Computer and Disk Drives to avoid possible damage from high voltages that may be produced while servicing power supply. Connect a load to the 5V and 12V source connector on the power supply. Three #1129 6-volt lamps in parallel may be used as a load for the 5V source. One #93 12-volt lamp may be used as a load for the 12V source. If lamps are used, use caution to avoid possible burns as the lamps get very hot.

NOTE: Operating power supply without a load may damage power supply.

The power supply produces a power failure signal (5V) at pin 4 of Plug P1 which will go low if the source voltages drop too low for Computer to continue processing. The power failure signal disables Controller IC (E6) on the System Board when it goes low. If the power failure signal is low and source voltages are normal, check voltages and components associated with Power Good Switch Transistor (Q55) and IC's IC55 and IC56.

The power supply has an automatic shutdown feature that is activated whenever an overload or overvoltage condition occurs. All source volt-

ages drop to 0V when shutdown occurs. To re-set power supply after shutdown occurs, turn power supply Off for about one minute and turn it back On.

Power supply dead. Check AC Fuse (F1). If Fuse F1 is open, check Bridge Rectifier (CR2) and check for possible shorts at Power Amp Transistor (Q1). If fuse is good, apply AC power and check for 120V AC across AC inputs of Rectifier CR2. If 120V AC is missing, check On-Off Switch (SW1), check Connector CP1, check Coils L1, L2 and Resistor R2. If 120V AC is present, check for 160V at collector of Switch Transistor (Q2). If 160V is missing, check Bridge Rectifier (CR2). If 160V is present, check waveform at pin 1 of Connector CP101. If waveform is missing, check voltages and components associated with pins 1 thru 12 of Oscillator (IC54), Amp Transistor (Q54), Voltage Regulator Transistor (Q101) and check windings on Transformers T1, T2, T51 and L51 for continuity.

12.0V Source 1 voltage is not correct. Check adjustment of 12V Adjust Control (R71), see "Miscellaneous Adjustments". If 12V Adjust control has no effect, check voltages and components associated with Error Amp (IC53), Error Amp Transistor (Q53) and 12V Regulator Transistor (Q51).

5.0V Source 4 voltage is not correct. Check adjustment of 5V Adjust Control (R93), see

TROUBLESHOOTING (Continued)

"Miscellaneous Adjustments". If 5V Adjust Control has no effect, check voltages and components associated with Oscillator (IC 54) .

MICROPROCESSOR (CPU) OPERATION

Microprocessor IC (J8) does not appear to be functioning. Check for 5V at pin 40 of IC J8. If 5V is missing, refer to the "Power Supply" section of this Troubleshooting guide. If 5V source is normal, check clock waveform at pin 19 of IC J8. If waveform is missing, refer to the "Clock Generator" section of this Troubleshooting guide. If waveform is good, turn Computer Off and check pin 21 of IC J8 for a reset pulse of about .3 sec width when Computer is turned On. If the reset pulse is missing, check IC E6 and IC F1. If the reset pulse is good, check pin 18 of IC J8 for a logic Low or pulse. If pin 18 stays High, check Interrupt Controller IC (C11). If the logic reading on pin 18 is a Low or pulse, check for a logic Low on pin 17 of IC C11. If pin 17 is High, check for pulses on pins 2 thru 16 and 35 thru 39 of IC C11. If any of the pins are logic High or Low, check IC C11.

CLOCK GENERATOR

Check for (14.31818MHz) at pin 17 of IC E6. If frequency is not correct or missing, check for 5V at pin 14 of X1. Check for a logic High at pin 7 of IC E6. If reading is Low, it will disable the signal from E6. If reading is Low, check connection at pin 4 of Connector P1 and check Transistor Q55 in the Power Supply. If Connector and Transistor are good, the Power Supply may be in shutdown condition. Refer to the "Power Supply (Shutdown)" section of this Troubleshooting guide. Check waveforms at pins 16, 19, 21 and 24 of IC E6. If any waveform is missing, check IC E6.

INTERNAL SPEAKER

No sound from speaker. Check Speaker (SP1) and Connector P4. If Speaker and Connector check normal, type in and run the following Basic program to produce a continuous sound signal to the speaker:

10 SOUND 200,200: GOTO 10

Check for pulses at pin 11 of IC H16. If pulses are present, check Electrolytic C18, Resistor R58 and Transistor TR03. If pulses are missing, check for pulses on pin 13 of IC H16 and a logic High on pin 12 of H16. If logic readings are correct, check H16. If pulses are missing on pin 13 of IC H16, check Timer IC (C14). If logic reading on pin 12 of IC H16 is Low, check Peripheral Interface IC (C16).

KEYBOARD

Keyboard does not function. Check Keyboard Connector P3 and P3A for good connections. If connections are good, check for pulses at pins 1 and 2 of P3 while pressing any key on the Keyboard. If pulses are missing at Connector P3, check for pulses at pins 35 and 36 of Microcomputer IC (Z4) on the Keyboard. If

pulses at pin 35 of IC Z4 are present, check IC Z7. If pulses at pin 37 of IC1 are present, check IC Z7. If pulses are missing at both pins 35 and 36, check waveform at pin 2 of IC Z4. If waveform is missing, check Crystal X1 and IC's Z3 and Z7. If waveform is present, check IC's Z1, Z2, Z3 and Z8. If pulses are present at pins 1 and 2 of Connector P3, check for pulses at pins 18 and 20 of Keyboard Interface IC (E16). If pulses are missing at pins 18 and 20 of IC E16, check IC M16 and M17. Check waveform at pin 24 of IC E16. If pulses are present at pins 18 and 20 of IC E16 and waveform is present at pin 24 of IC E16, check IC E16 and IC C16. If waveform is missing at pin 24 of IC E16, check Oscillator Module (X4).

SERIAL PORT

Serial port does not work. Disconnect any peripheral equipment connected to Serial Port Connector (J8). Check waveform at pin 16 of Serial Interface IC (D18) and check the frequency (1.8432MHz). If waveform is missing, check Keyboard Interface IC (E16). If waveform and frequency are good at pin 16 of IC D18, plug in a Serial Loopback socket, see TEST PLUGS, Into Connector J8. Type in and run the following Basic program:

10 OUT 1019,131
20 OUT 1016,128: OUT 1017,1
30 OUT 1019,3
40 OUT 1020,0: OUT 1020,15
50 OUT 1016,255: GOTO 40

NOTE: Be sure Jumper JP10 is set to pins 1 and 2 to select the COM1 port.

The program sets the baud rate to 300 baud and causes pulses to appear at pins 11 and 31 thru 34 of IC D18. The waveform at pin 11 of IC D18 should look like Figure A, pin 15 of IC D18 should like like Figure B and pins 31 thru 34 of IC D18 should look like Figure C. The peak-to-peak voltage on pins 31 and 34 of IC D18 should be 5V and pins 32 and 33 should be 4.0V.

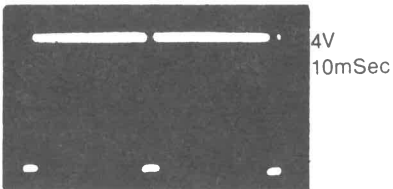


Figure A

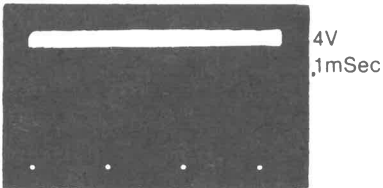


Figure B

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC K16	PIN NO.	IC K16	PIN NO.	IC L4	IC L5	IC L6	IC L7	IC L8	IC L10	IC L11	IC L15	IC M3	IC M4
1	H	21	P	1	H	P	P	P	P	L	P	P	P	P
2	P	22	P	2	L	H	P	P	P	P	P	P	P	P
3	P	23	P	3	P	*	P	P	P	P	P	P	P	P
4	P	24	P	4	H	*	P	P	P	P	P	P	P	P
5	P	25	P	5	L	H	P	P	P	P	P	P	P	P
6	P	26	P	6	H	H	P	P	P	P	P	P	P	P
7	P	27	H	7	L	*	P	P	P	L	P	P	P	P
8	P	28	H	8	H	*	P	P	P	P	P	P	H	H
9	P			9	L	H	P	P	P	P	P	P	P	P
10	P			10	H	L	L	L	L	P	L	L	P	P
11	P			11	P	P	P	P	P	*	P	P	P	P
12	P			12	L	P	P	P	P	*	P	P	P	P
13	P			14	H	P	P	P	P	L	P	P	P	P
14	L			14	H	P	P	P	P	H	P	P	P	P
15	P			15		P	P	P	P		P	P	P	P
16	P			16		P	P	P	P		P	P	L	L
17	P			17		P	P	P	P		P	P		
18	P			18		P	P	P	P		P	P		
19	P			19		P	P	P	P		P	P		
20	P			20		H	H	H	H		H	H		

PIN NO.	IC M5A	IC M5B	IC M6	IC M7	IC M8	IC M9	IC M10	IC M12	IC M13	IC M16	IC M18	IC M19
1	P	P	P	P	P	P	P	P	P	L	H	L
2	P	P	P	P	P	P	P	P	P	H	L	L
3	P	P	P	P	P	P	P	P	P	H	H	L
4	P	P	P	P	P	P	P	P	P	L	P	L
5	P	P	P	P	P	P	P	P	P	P	P	P
6	P	P	P	P	P	P	P	P	P	P	H	H
7	P	P	P	P	P	P	P	P	P	L	L	H
8	H	H	H	H	H	H	H	L	L	P	L	L
9	P	P	P	P	P	P	P	P	P	L	H	H
10	P	P	P	P	P	P	P	P	P	H	L	H
11	P	P	P	P	P	P	P	P	P	H	H	H
12	P	P	P	P	P	P	P	P	P	L	P	H
13	P	P	P	P	P	P	P	P	P	H	P	H
14	P	P	P	P	P	P	P	P	P	H	H	H
15	P	P	P	P	P	P	P	L	L		L	P
16	L	L	L	L	L	L	L	H	H		H	H

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC H5	IC H10	IC H11	IC H16	IC J3	IC J8	PIN NO.	IC J8
1	P	P	*	H	H	L	21	L
2	P	P	*	H	L	P	22	P
3	P	P	H	L	L	P	23	H
4	P	P	P	H	L	P	24	P
5	P	H	L	H	L	P	25	P
6	P	H	L	L	L	P	26	P
7	L	H	L	L	L	P	27	P
8	L	L	P	L	L	P	28	P
9	*	H	H	H	L	P	29	P
10	*	H	P	H	P	P	30	H
11	P	H	P	H	L	P	31	H
12	P	P	P	L	L	P	32	P
13	P	P	P	H	H	P	33	L
14	H	P	H	H	P	P	34	H
15		P			*	P	35	P
16		H			H	P	36	P
17						L	37	P
18						P	38	P
19						P	39	P
20						L	40	H

PIN NO.	IC J9	IC J10	IC J15	PIN NO.	IC J15	PIN NO.	IC K3	IC K4	IC K10	IC K11
1	P	P	H	21	P	1	P	P	P	P
2	P	P	P	22	P	2	H	L	P	P
3	P	*	P	23	P	3	H	L	P	*
4	P	P	P	24	H	4	P	H	P	P
5	P	P	H	25	P	5	H	P	L	P
6	P	P	P	26	P	6	H	P	H	P
7	L	L	P	27	P	7	L	L	L	L
8	P	P	P	28	P	8	H	H	P	P
9	P	P	P	29	P	9	P	H	P	P
10	P	P	P	30	P	10	H	H	P	P
11	P	*	P	31	H	11	H	L	P	P
12	L	P	P	32	P	12	H	P	P	P
13	P	P	L	33	P	13	H	L	P	P
14	H	H	H	34	P	14	H	H	H	H
15			H	35	P					
16			*	36	P					
17			L	37	P					
18			*	38	P					
19			P	39	P					
20			L	40	P					

TROUBLESHOOTING (Continued)

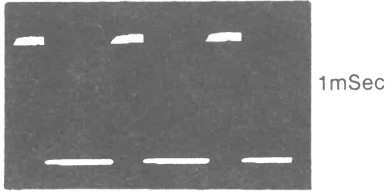


Figure C

While program is running, check for pulses at pin 8 of IC A12. If pulses are missing, check IC A12. If pulses are present, check waveforms at pins 11, 15 and 31 thru 34 of IC D18. If any waveforms are missing or not correct, check IC D18. If waveforms are good, check for pulses at pin 3 of IC D17. If pulses are missing, check IC D17. If pulses are present, check for pulses at pins 6, 8 and 11 of IC B19. If pulses are missing, check IC B19 and Diodes D03 and D04. If pulses are present, check for pulses at pins 8, 10 and 12 of IC C17. If pulses are missing, check IC C17. If pulses are present, check for pulses at pins 9 thru 13 of IC B18. If pulses are missing, check IC B18.

To check the Interrupt Request Function (pin 30) of IC D18, turn Computer Off and remove Serial Loopback socket from Connector J8. Turn Computer back On, load BASICA and type in and run the following program:

```
10 OUT 1020,15: OUT 1017,15
20 OUT 1016,255: GOTO 10
```

While program is running, check for a logic Low at pin 31 of IC D18. If pin 31 does not read logic Low, check IC D18. If reading is correct, check for pulses at pins 1 and 3 of IC E2. If pulses are missing at pin 1, check IC D18. If pulses are present at pin 1 and missing at at pin 2, check IC E2. If pulses are present at pins 1 and 3 of IC E2, check for pulses at pin 11 of IC D17. If pulses are missing, check IC D17.

REAL TIME CLOCK

Time must be reset each time Computer is turned On. With Computer turned Off, check for about 5V at pin 13 of Real Time Clock IC (J3). If voltage is missing or very low, check Battery (BT1), Electrolytic C09 and Resistor R72. If voltage is correct, type in and run the following Basic program:

```
10 TIMES$="11:11:11": GOTO 10
```

The program continuously sets the time to 11:11:11. While program is running, check for pulses at pins 3 and 11 of IC K3. If pulses are missing, check IC K3. If pulses are present, check for pulses at pins 6, 9, 12, 15, 16 and 19 of Flip/Flop IC (H2). If pulses are missing, check IC H2. If pulses are present, check for pulses at pins 5 and 9 of Flip/Flop IC (L4). If pulses are missing, check IC L4. If pulses are present, check IC's J3, H4 and M1.

Time cannot be set or read. Check Timer IC (C14). Real time clock does not keep correct time. Check 1.193MHz clock waveform at pin 17 of Register IC (E16). If waveform is missing, check IC E16. If frequency is not correct, check frequency of 14.31818MHz Oscillator (X1) at pin 17 of IC E6. If frequency is not correct, check Oscillator X1. If frequency is correct at pin 17 of IC E6, check Timer IC (C14).

The 5V/BATT Switch Transistor (TR02) is used to isolate Battery BT1 from the 5V source line when Computer is Off. To check operation of Transistor TR02, check for 5.0V on the collector of TR02 when Computer is On (voltage should be about 4V with Computer Off). If reading is not correct, check voltages and components associated with Transistors TR01 and TR02.

DISK DRIVE INTERFACE OSCILLATORS

Verify oscillators are working by checking for a 9.6MHz waveform at pin 1 of IC F14 and a 16MHz waveform at pin 13 of IC F14. If waveform is not correct at pin 1, check the 9600kHz Oscillator Module (X3). If waveform is not correct at pin 13, check the 16MHz Oscillator Module (X2).

WILL NOT READ

Insert a diskette containing data in Disk Drive B and close the door. Type in and run the following Basic program to keep Disk Drive running in read mode:

```
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 OUT 1013,74:S=INP(1012)
40 OUT 1013,Y:S=INP(1012)
50 FOR X=1 TO 7
60 S=INP(1013):S=INP(1012):PRINT S
70 NEXT X:LOCATE 1,1
80 IF Y =1 THEN Y=5 ELSE Y=1
90 GOTO 20
```

To operate Drive A, change line 20 to:
OUT 1014,128:OUT 1010, 16:OUT 1010,20

While program is running, check for pulses at pin 4 of Buffer IC (G15). If pulses are missing, refer to the "Disk Drive" Troubleshooting in the Disk Drive folder. If pulses are present, check for a logic Low at pin 1 of IC G15. If reading is not correct, check IC H19. If reading is correct, check for pulses at pin 16 of IC G15. If pulses are missing, check IC G15. If pulses are present, check for pulses at pins 8, 9 and 19 of Data Separator IC (M1). If pulses are missing, check IC M1. If pulses are present, check Disk Controller IC (H17).

WILL NOT WRITE

Insert a blank diskette into Disk Drive B and close the door. Type in and run the following Basic program which writes continuously to the Diskette and displays a number on the upper left corner of the Monitor screen. The number should be 0 when Diskette is not write protected and change to 2 when a write protected Diskette is inserted into the Drive.

CSCS20
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MODEL HT

TROUBLESHOOTING (Continued)

```

10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 S=INP(1012)
40 OUT 1013,77:S=INP(1012)
50 OUT 1013,Y:S=INP(1012)
60 OUT 1013,1:S=INP(1012)
70 OUT 1013,12:S=INP(1012)
80 OUT 1013,12:S=INP(1012)
90 OUT 1013,0:S=INP(1012)
100 S=INP(1013):S=INP(1012)
110 PRINT INP(1013) AND 2:S=INP(1012)
120 FOR X=1 TO 5
130 S=INP(1013):S=INP(1012)
140 NEXT X:LOCATE 1,1
150 IF Y=1 THEN Y=5 ELSE Y=1
160 GOTO 20

```

NOTE: This program will not write to diskette if diskette index detector circuits are not working. See "Index Detector" section of this Troubleshooting guide.

While program is running, insert a diskette that is not write protected into the Drive and check for the number 0 on the Monitor screen, then insert a write protected diskette into the Drive and check for the number 2 on the Monitor screen. If numbers are not correct, refer to the "Write Protect Does Not Function" section of this Troubleshooting guide.

While program is running, check for pulses at pins 25 and 30 of Disk Controller IC (H17). If pulses are missing, check IC H17. If pulses are present, check for pulses at pin 34 of Controller IC (H19). If pulses are missing, check IC H19. If pulses are present, check for pulses at pins 1 and 3 of Driver IC (E19). If pulses are missing at pin 1, check IC F10. If pulses are present at pin 1 and missing at pin 3, check IC E19.

INDEX DETECTOR

Check for pulses at pin 17 of Disk Controller IC (H17) while running program listed under "Will Not Read" with a diskette inserted in Drive B. If pulses are missing, check for pulses at pin 17 of Buffer IC (G15). If pulses are present at pin 17 of IC G15, check IC G15. If pulses are missing, check pin 8 of Connector P8 and check Disk Drive cable. If connector and cable are good, refer to the "Index Detector" section of the Disk Drive Troubleshooting in the Disk Drive Folder.

WRITE PROTECT DOES NOT FUNCTION

Type in and run program listed under the "Will Not Write" section of this Troubleshooting guide. The program will display the number 0 on the left upper corner of the Monitor screen if a diskette that is not write protected is inserted into the Drive and number 2 if diskette is write protected.

WARNING: This program also writes on the diskette. Do not use a diskette that has important data on it. If numbers on Monitor screen are not correct, check for a logic Low at pin 8 of Buffer IC (G15) with a write protected diskette in Drive B and a logic High with a diskette that is not write protected in

Drive B. If readings are not correct, refer to the "Disk Drive" Troubleshooting in the Disk Drive Folder. If readings are correct, check for a logic Low at pin 1 of IC G15. If reading is not correct, check IC H19. If reading is correct, check for a logic High at pin 12 of IC G15 with a write protected diskette in Drive B and a logic Low with a diskette that is not write protected in Drive B. If readings are not correct, check IC G15. If readings are correct, check Disk Controller IC (H17).

HEAD POSITION MOTOR

Head Position Motor does not work on Drive A or B. Type in and run the following Basic program. The program continuously alternates Head on Drive B between Tracks 00 and 16.

```

10 OUT 1014,128:OUT 1010,33:OUT 1010,37
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1010,37
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10

```

While program is running, check for pulses at pins 37 and 38 of Disk Controller IC H17. If pulses are missing, check IC H17. If pulses are present, check for pulses at pins 6 and 8 of IC E18. If pulses are missing, check IC E18. If pulses are present, check for pulses on pins 8 and 11 of IC F19. If pulses are missing, check IC F19. If pulses are present, check Connector P8 for good connections and check Disk Drive cable for continuity.

TRACK 00 DETECTOR

Disk Drive Head bangs against Track 00 stop. Type in and run the following Basic program to check Track 00 detector circuits. The program will step the Head back to Track 00 and display the number 16 on the Monitor screen to indicate Head is on Track 00. If Head is manually pushed off Track 00, the number should change to number 0.

Drive A

```

10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,20
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40

```

If number on Monitor screen is not correct, check for a logic Low at pin 2 of Buffer IC (G15) when Head is on Track 00 and logic High when Head is off Track 00. If readings are not correct, check pin 26 of Connector P8 for good connections and check drive cable for continuity. If readings are correct, check for a logic Low at pin 1 of IC G15. If read-

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC F11	IC F17	IC G1	IC G2	IC G3	IC G4	IC G6	IC G7	IC G8
1	P	P	H	H	P	P	P	L	P
2	P	P	P	*	L	H	P	P	P
3	P	*	P	H	P	H	*	P	P
4	H	P	H	P	P	P	P	P	P
5	H	P	P	*	P	H	*	P	P
6	P	P	P	*	P	P	P	P	P
7	P	L	L	H	L	P	*	P	P
8	L	L	L	L	P	H	H	P	P
9	P	H	H	P	P	H	*	P	P
10	P	H	H	P	P	L	L	L	L
11	P	*	P	H	P	H	*	P	P
12	H	H	H	P	H	H	H	P	P
13	P	H	H	P	L	P	*	H	P
14	P	H	H	P	H	P	P	P	P
15	P			H		H	*	P	P
16	H			H		P	P	P	P
17						H	*	P	P
18						H	P	P	P
19						L	*	P	P
20						H	H	H	H

PIN NO.	IC G9	IC G10	IC G11	IC G12	IC G13	IC G14	IC H1	IC H2	IC H3
1	*	L	P	P	P	P	H	H	H
2	*	P	P	P	P	P	L	L	P
3	H	P	*	*	P	P	L	P	P
4	P	P	P	P	P	P	L	P	P
5	P	P	P	P	P	P	L	L	P
6	P	P	P	H	P	P	L	L	P
7	L	L	L	L	P	P	L	P	P
8	P	P	P	P	P	P	L	P	P
9	H	P	P	P	P	P	L	L	P
10	P	P	P	P	L	L	L	L	L
11	P	P	*	*	P	P	L	H	P
12	P	P	P	P	P	P	P	L	P
13	P	P	P	P	P	P	L	P	P
14	H	H	H	H	P	P	P	P	P
15					P	P	L	L	P
16					P	P	P	L	P
17					P	P	L	P	P
18					P	P	P	P	P
19					P	P	L	L	L
20					H	H	H	H	H

LOGIC CHART (Continued)

SYSTEM BOARD

PIN NO.	IC D17	IC D18	PIN NO.	IC D18	PIN NO.	IC E2	IC E3	IC E4	IC E5	IC E6	PIN NO.	IC E6	PIN NO.	IC E7
1	L	P	21	H	1	L	P	H	P	H	21	P	1	P
2	H	P	22	L	2	L	P	L	P	P	22	P	2	P
3	H	P	23	H	3	L	H	P	P	P	23	L	3	H
4	*	P	24	P	4	P	H	P	P	H	24	P	4	
5	*	P	25	L	5	P	H	L	P	P	25	*	5	
6	*	P	26	P	6	P	L	H	P	H	26	P	6	
7	L	P	27	P	7	L	L	L	L	H	27	P	7	
8	*	P	28	P	8	L	P	L	L	P	28	P	8	
9	L	P	29	*	9	L	H	H	*	H	29	P	9	
10	H	H	30	L	10	H	P	H	*	P	30	P	10	
11	H	H	31	H	11	P	H	L	P	P	31	P	11	
12	L	H	32	H	12	P	P	L	P	P	32	P	12	
13	H	H	33	H	13	P	H	H	P	P	33	P	13	
14	H	P	34	H	14	H	H	H	H		34	*	14	H
15		P	35	L						*	35	P		
16		P	36	H						P	36	P		
17		P	37	H						P	37	P		
18		P	38	H						L	38	P		
19		L	39	H						P	39	P		
20		L	40	H						L	40	H		

PIN NO.	IC E10	IC E11	IC E16	PIN NO.	IC E16	PIN NO.	IC F1	IC F2	IC F3	IC F5
1	P	L	*	21	L	1	H	*	H	P
2	P	P	L	22	*	2	P	*	H	*
3	P	P	L	23	P	3	H	*	L	*
4	P	P	L	24	P	4	H	*	L	*
5	P	P	L	25	H	5	H	H	H	*
6	P	P	L	26	L	6	L	L	H	L
7	P	P	H	27	P	7	L	L	L	L
8	P	P	P	28	P	8	P	P	H	P
9	P	P	L	29	P	9	P	P	*	P
10	H	L	P	30	P	10	H	H	L	L
11	P	P	L	31	P	11	P	P	P	*
12	P	P	*	32	H	12	P	P	P	*
13	P	P	P	33	P	13	H	H	H	H
14	P	P	P	34	P	14	H	H	H	H
15	P	P	P	35	L					
16	P	P	P	36	L					
17	P	P	P	37	L					
18	P	P	H	38	L					
19	P	L	H	39	L					
20	H	H	P	40	L					
				41	L					
				42	H					

TROUBLESHOOTING (Continued)

ing is not correct, check IC H19. If reading is correct, check for a logic High at pin 18 of IC G15 when Head is on Track 00 and logic Low when Head is off Track 00. If readings are not correct, check IC G15. If readings are correct, check for logic High with momen- tary pulses at pin 8 of IC F14 when Head is on Track 00 and a logic Low when Head is off Track 00. If readings are not correct, check IC F14. If readings are correct, check Disk Controller IC (H17).

MISCELLANEOUS ADJUSTMENTS

POWER SUPPLY

5V Adjust

Connect positive input of a voltmeter to 5.0V Source 4, negative input to ground. Adjust 5V adjust Control (R93) for 5.0V.

12V Adjust

Connect positive input of a voltmeter to 12.0V Source 1, negative input to ground. Adjust 12V Adjust Control (R71) for 12.0V.

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the Computer system to water. If exposed to water turn the unit Off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.

SCHEMATIC NOTES

- Circuitry not used in some versions
- Circuitry used in some versions
 - See Parts List
- ⊥ Ground
- ⏏ Chassis
- ▽ Common tie point

Voltages, Logic Readings and Waveforms taken with Computer in Power Up mode unless noted. Computer turned On, no keys pressed, no diskettes in drives. The following message appears on the Monitor screen: E-FD20-TIMEOUT ERROR. All Switches on DIP Switch SW3 (on System Board) are set to On.

Voltages, Logic Readings and Waveforms for Disk Drive Interface Components were taken with Disk Drive "B" running the following Basic Program:

```
10 OPEN "B:SAMS.DATA" FOR OUTPUT AS #1
20 FOR X=1 TO 300
30 PRINT#1, "HOWARD W SAMS"
40 NEXT X
50 CLOSE #1
60 GOTO 10
```

Waveforms and voltages taken from ground, unless noted otherwise.

Waveforms taken with triggered scope and Sweep/Time Switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm width with DC reference voltage given at the bottom line of each waveform.

Time in usec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

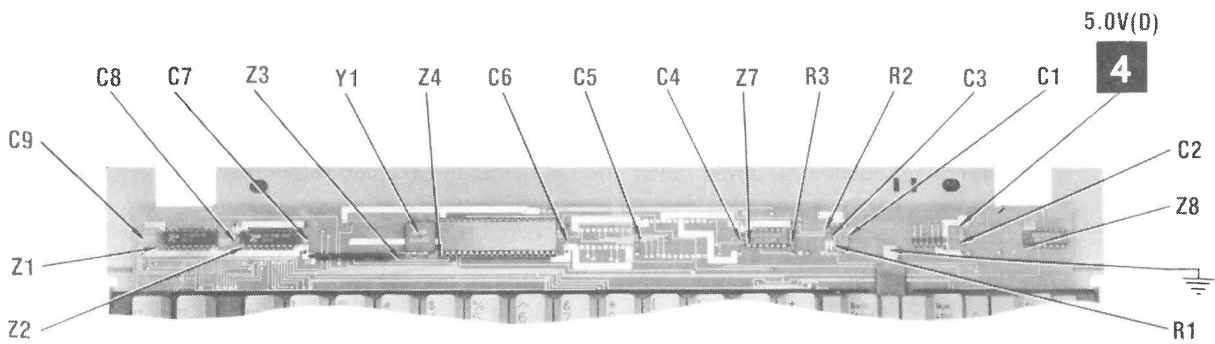
Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display

- L = Low
- H = High
- P = Pulse
- * = Open (No light On)

- (1) Probe Indicates P when Head Position motor is operating.
- (2) Probe Indicates H when Head is on track 00 and L when off track 00.
- (3) Probe Indicates L when Head is on track 00 and H when off track 00.



NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

LOGIC CHART (Continued)

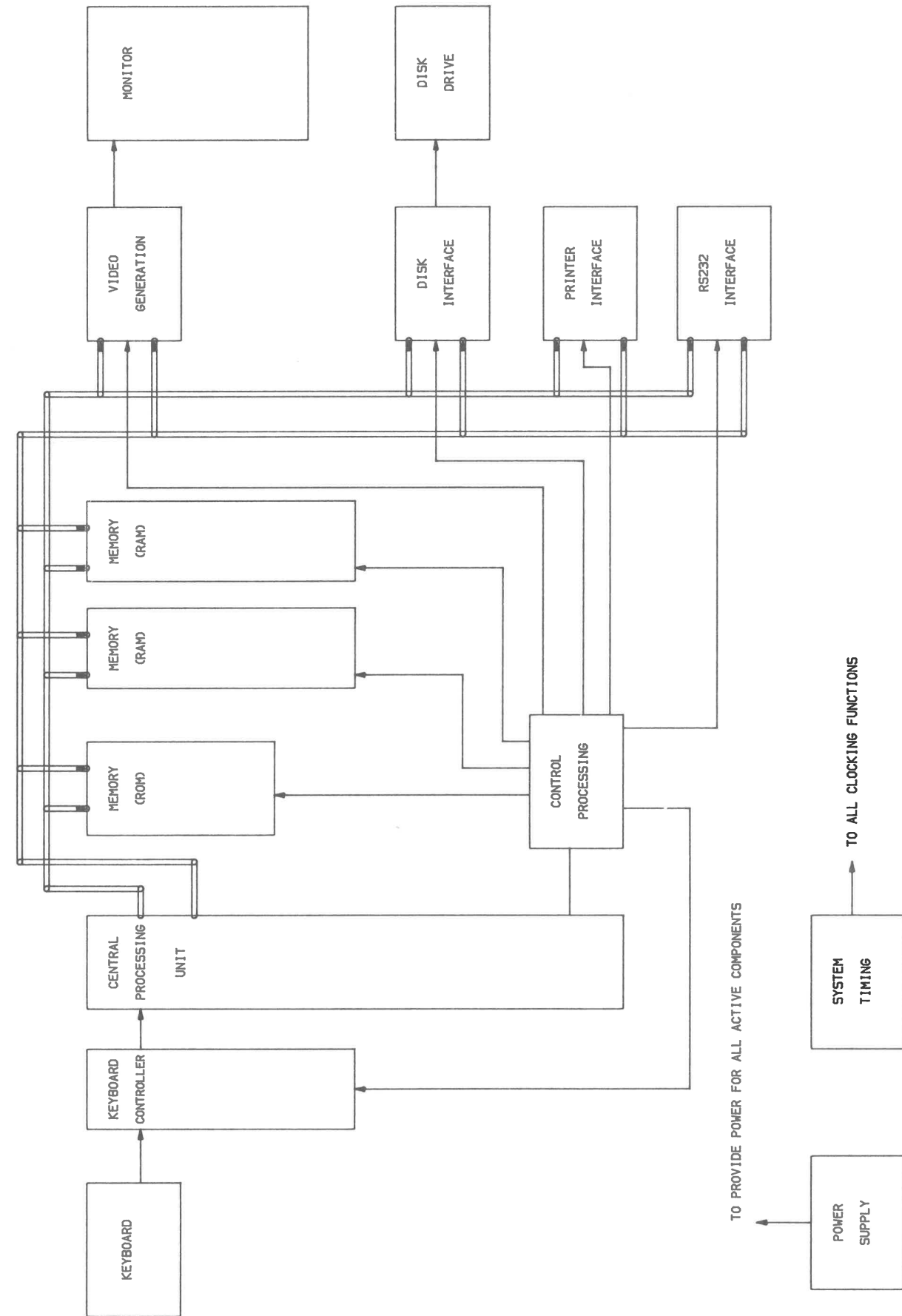
PIN NO.	IC A11	IC A12	IC A13	IC A15	IC A16	IC A17	IC B11	IC B13	IC B17	IC B18	IC B19
1	H	L	*	H	H	*		P	L	H	L
2	L	H	*	H	L	*		P	L	H	*
3	L	P	*	L	P	*		P	H	H	L
4	H	P	*	H	L	L		P	L	L	H
5	H	H	H	L	P	H		P	L	L	H
6	L	L	L	L	L	L		P	L	L	L
7	L	L	L	L	P		L	P	H	L	L
8	L	H	P	H	L		H	L	L	L	L
9	*	L	P	L	P		L	P	H	H	H
10	H	H	H	L	L		H	P	H	H	H
11	L	L	P	L	L		P	P	H	H	L
12	L	L	H	L	P		P	P	H	H	H
13	H	*	P	H	L		H	P	H	H	H
14	H	H	H	L	P		H	P	L	H	H
15				H	H			P	H	H	
16				L	P			H	H	H	
17				H	L						
18				L	P						
19				H	H						
20				H	H						

PIN NO.	IC C11	PIN NO.1	IC C11	PIN NO.	IC C13	IC C14	PIN NO.	IC C14	PIN NO.	IC C16	PIN NO.	IC C16	PIN NO.	IC C17	IC D7
1	P	21	H	1	P	P	21	P	1	L	21	H	1	*	P
2	P	22	H	2	P	P	22	H	2	L	22	L	2	L	P
3	H	23	H	3	H	P	23	P	3	L	23	L	3	*	P
4	P	24	L	4	H	P	24	H	4	L	24	H	4	L	P
5	P	25	H	5	P	P			5	H	25	L	5	*	P
6	P	26	P	6	H	P			6	P	26	H	6	L	P
7	P	27	P	7	L	P			7	L	27	P	7	L	L
8	P	28	H	8	P	P			8	P	28	P	8	L	P
9	P			9	P	P			9	P	29	P	9	H	P
10	P			10	P	P			10	L	30	P	10	L	P
11	P			11	H	H			11	L	31	P	11	H	P
12	L			12	P	L			12	H	32	P	12	L	L
13	L			13	P	P			13	*	33	P	13	H	H
14	L			14	H	H			14	L	34	P	14	H	H
15	P			15		P			15	H	35	L			
16	P			16		L			16	H	36	P			
17	P			17		H			17	L	37	L			
18	P			18		P			18	L	38	L			
19	L			19		P			19	L	39	L			
20	H			20		P			20	H	40	L			

DISK DRIVE INTERFACE (SYSTEM BOARD)

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CSCS20
SPERRY
MODEL HT



BLOCK DIAGRAM

DISASSEMBLY INSTRUCTIONS

MAIN SYSTEM UNIT

Remove five screws from cabinet (one from rear and two from each side). Slide cabinet forward and remove from unit.

POWER SUPPLY REMOVAL

Disconnect Connectors P1 and P2 from System Board and Connector P8 from Disk Drives. Remove four screws from rear of Power Supply cabinet. Push Power Supply forward about 1/2 inch to clear mounting tabs on cabinet bottom and lift Power supply from unit.

POWER SUPPLY

Remove two screws from top left side and three screws from right side of Power Supply case (as viewed with fan on front). Lift top section up and remove. Squeeze in strain relief holding wires on left side and remove. Remove one screw from left front center. Lift up front section (with the fan) about 1/2 inch and slide it forward about three inches. Disconnect AC Connector from lower board (next to fuses). Remove screw holding ground wire from lower board to Power Supply case. Slide front section, with two boards attached, out of case. Remove one screw from center of top board and two screws holding top board to front section. Disconnect Fan Connector from

top board and connector connecting top board to bottom board and remove top board. Remove two screws holding bottom board to front section and remove bottom board.

DISK DRIVE REMOVAL

Disconnect Disk Drive Connector and Power Supply Connector from rear of each Disk Drive. Remove two screws from front sides of Disk Drive bracket. Slide Drive bracket forward and remove from chassis. Remove four screws from each side of Drive bracket and remove Disk Drives from bracket.

SYSTEM BOARD REMOVAL

Remove all Adapter boards from expansion slots. Disconnect Disk Drive Connectors and Power Supply Connectors from System Board. Disconnect Speaker Connectors. Remove six screws holding System Board to cabinet bottom. Lift System Board from unit.

KEYBOARD

Lay Keyboard facedown and remove four screws holding lower case. Lift lower case up and out of upper case. Keyboard assembly may now be removed from lower case by removing two screws at each end of assembly.

LOGIC CHART

KEYBOARD

PIN NO.	IC Z1	IC Z3	IC Z3	IC Z4	PIN NO.	IC Z4	PIN NO.	IC Z7	IC Z8
1	P	P	H	P	21	P	1	P	H
2	P	P	P	P	22	P	2	L	L
3	P	P	P	P	23	P	3	P	H
4	L	P	H	H	24	P	4	L	H
5	P	P	H	H	25	P	5	H	H
6	P	P	H	*	26	H	6	H	L
7	P	P	L	L	27	P	7	L	L
8	P	P	H	H	28	P	8	H(1)	P
9	P	P	H	H	29	P	9	L	H
10	L	L	H	H	30	P	10	H(1)	P
11	P	P	P	P	31	P	11	H	L(1)
12	P	P	P	*	32	H	12	H	H(1)
13	P	H	H	*	33	P	13	L	H
14	P	P	H	*	34	P	14	H	H
15	P	P	H	*	35	P	15		
16	P	P	L	*	36	H(1)			
17	P	P		*	37	H			
18	P	P		*	38	H			
19	P	P		*	39	L(1)			
20	H	H		L	40	H			

(1) Probe Indicates P when a key is pressed.

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
L1	POWER SUPPLY			
L2	AC Line Filter			
L51	AC Line Filter			
L52	Switching Transformer			
T1	RF Choke			
T2	Power			
T51	Coupling			
	Coupling			

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	POWER SUPPLY			
F2	4 Amp @ 250V Slow Blow			
	3 Amp @ 250V Slow Blow			

SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFGR. PART No.	QUAM PART No.	
SP1	2-1/4" CM, 8 Ohms		22A05Z8	

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
D1	KEYBOARD		
D2	LED		Number Lock, Green
S1	LED		Caps Lock, Green
thru	Switch		Key
S84			
X1	Crystal		4.608MHz
	POWER SUPPLY		
SW1	Switch		Power
	SYSTEM BOARD		
BT1	Battery		3.6V
DL1	Delay Line		
DL2	Delay Line		
DL3	Delay Line		
L10	Ferrite Bead		
LED1	LED		Power, Green
SW1	Switch		DIP
SW2	Switch		DIP
SW3	Switch		DIP
X1	Module		Oscillator 14318.18kHz
X2	Module		Oscillator 16MHz
X3	Module		Oscillator 9600kHz
X4	Module		Oscillator 7372.800kHz
X5	Crystal		

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
KEYBOARD						
Z1	22-950-3B	NTE74LS125A	ECG74LS125A	SK74LS125A	HE-443-811	
Z2	22-908-03B	NTE74LS132	ECG74LS132	SK7CT132	HE-443-792	
Z3	22-00920-000	NTE5314	ECG5314	SK3987/5314	103-131	
Z4	TMP8048P-1877	NTE519	ECG519	SK3100/519	103-Z9041	
Z7	SN74LS125AN	NTE5068A	ECG5068A	SK4V3/5068A	212-76-02	
Z8	SN74LS132N	NTE116	ECG116	SK3313/116	212-Z9000	
RECTIFIER BOARD		NTE5804	ECG5804	SK9007/5804	103-131	
CR1	AC08D	NTE5007A	ECG5007A	SK3A9/5007A	103-131	
CR2	KBPC804	NTE519	ECG519	SK3100/519	103-131	
CR3	S118	NTE519	ECG519	SK3100/519	103-131	
CR4,5	F1-06	NTE519	ECG519	SK3100/519	103-131	
CR6,7	39B2	NTE519	ECG519	SK3100/519	103-131	
CR8	15B2	NTE519	ECG519	SK3100/519	103-131	
CR9	GP30G	NTE519	ECG519	SK3100/519	103-131	
CR10	3.9B2	NTE519	ECG519	SK3100/519	103-131	
CR11	S118	NTE519	ECG519	SK3100/519	103-131	
CR12,13	F1-06	NTE519	ECG519	SK3100/519	103-131	
CR14	S118	NTE519	ECG519	SK3100/519	103-131	
CR101	B8400950	NTE519	ECG519	SK3100/519	103-131	
CR102	S118	NTE519	ECG519	SK3100/519	103-131	
CR103	15B2	NTE519	ECG519	SK3100/519	103-131	
CR104,5	S118	NTE519	ECG519	SK3100/519	103-131	
IC1	H0004	NTE519	ECG519	SK3100/519	103-131	
Q1	2SC3320	NTE519	ECG519	SK3100/519	103-131	
Q2	2SC2899	NTE519	ECG519	SK3100/519	103-131	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./TYPE No.					NOTES
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
REGULATOR BOARD						
CR51	00963					
CR52	B35-0262					
CR53	S118	NTE519	ECG519	SK3100/519	103-131	
CR54	B35-0262					
CR55	S118	NTE519	ECG519	SK3100/519	103-131	
CR56	CTL-2S					
CR57	S118	NTE519	ECG6240	SK5060/6240	103-131	
CR58	3-3B2		ECG519	SK3100/519		
CR59, 60	CTB-34	NTE6246	ECG6246			
CR61	5-1B2	NTE5010A	ECG5010A	SK5A1/5010A	103-279-10	
CR62, 63, 64	S118	NTE519	ECG519	SK3100/519	103-131	
CR65	12B2	NTE142A	ECG142A	SK12V/142A	103-Z9003	
CR66	S118	NTE519	ECG519	SK3100/519	103-131	
CR67	4-7B2	NTE5009A	ECG5009A	SK4A7/5009A	103-279-09	
CR68, 69, 70	S118	NTE519	ECG519	SK3100/519	103-131	
IC51	78M05	NTE960	ECG960	SK3591/960	221-Z9043	
IC52	78M12	NTE966	ECG966	SK3592/966	HE-442-674	
IC53	C305C (IC)					
IC54	H0005					
IC55, 56	UPC339C [uPC339C]	NTE834	ECG834	SK3569/834	221-121	
Q51	D1064 (JAPAN)	NTE390	ECG390	SK3958/390	121-Z9113	* *
Q52	D1060 (JAPAN)	NTE383	ECG383	SK9138/383	921-1115	
Q53	A1015Y (JAPAN)	NTE290A	ECG290A	SK9132	121-Z9003	
Q54	C26550 (JAPAN)	NTE293	ECG293	SK3849/293	121-Z9066	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C1	POWER SUPPLY	
C2	.047 125VAC	
	.047 125VAC	

ITEM No.	RATING	MFGR. PART No.
	SYSTEM BOARD	
C07	22 NPO 50V 5%	
C08	15 NPO 50V 5%	
C11	470 NPO 50V 5%	
C17	47 NPO 50V 5%	
C19	47 NPO 50V 5%	
C20	470 NPO 50V 5%	
C21	470 NPO 50V 5%	

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R2	POWER SUPPLY			
R108	22 5% 5W WW		5W022	
R118	PTC 54.9 Cold			FR605
R127	PTC 54.6 Cold			FR605
	4300 1% 1/4W Carbon Film			
	SYSTEM BOARD			
R01	Resistor Network	(1)		
R02	Resistor Network	(2)		
R03	Resistor Network	(3)		
R04	Resistor Network	(4)		
R05	Resistor Network	(5)		
R06	Resistor Network	(1)		
R07	Resistor Network	(2)		
R08	Resistor Network	(5)		
R13	Resistor Network	(6)		
R14	Resistor Network	(6)		
R19	Resistor Network	(7)		
R20	Resistor Network	(8)		
R23	Resistor Network	(9)		
R24	Resistor Network	(10)		
R25	Resistor Network	(9)		
R29	Resistor Network	(11)		
R33	Resistor Network	(12)		
R35	Resistor Network	(13)		
R55	Resistor Network	(11)		
R56	Resistor Network	(11)		

- (1) 680 5% x 8
(2) 330 5% x 8
(3) 680 5% x 4
(4) 330 5% x 4
- (5) 4700 5% x 4
(6) 8200 5% x 8
(7) 8200 5% x 7
(8) 2200 5% x 4
- (9) 4700 5% x 8
(10) 22 5% x 4
(11) 33 5% x 4
(12) 5000 5% x 8
(13) 4700 5% x 2

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R71	POWER SUPPLY			
R93	Voltage Adjust 5V Adjust	2000 2000		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.				
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No. NOTES
L1,15 M1 M3,4 M5A,B M6 THRU M10	M74LS245P SED9420C HM50256P-15 HM50256P-15 HM50256P-15	NTE74LS245	ECG74LS245	SK74LS245	HE-443-885
M12,13 M14 M16 M18 M19	M74LS158P SN74LS04N SN74LS125AN M74LS175P SN74LS138N	NTE74LS158 NTE74LS04 NTE74LS125A NTE74LS175 NTE74LS138	ECG74LS158 ECG74LS04 ECG74LS125A ECG74LS175 ECG74LS138	SK7CT158 SK74LS04 SK74LS125A SK74LS175 SK74LS138	HE-443-755 HE-443-811 HE-443-752 HE-443-877
TR01 TR02 TR03	C945P(JAPAN) A1015Y(JAPAN) C2320(JAPAN)	NTE85 NTE290A NTE85	ECG85 ECG290A ECG85	SK3124A/289A SK9132 SK9229/85	121-972 * 121-Z9003 * 921-1114

WIRING DATA

Shielded Hook-up Wire	Use BELDEN No. 8401 or 8421 (Single-Conductor)
General-use Unshielded Hook-up Wire	Use BELDEN No. 8208 (Two-Conductor) 8529 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.				
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No. NOTES
SYSTEM BOARD					
A11 A12 A13 A15,16 A17	M74LS14P SN74LS04N M74LS74AP HD74LS244P TLP531	NTE74LS14 NTE74LS04 NTE74LS74A NTE74LS244 NTE3041	ECG74LS14 ECG74LS04 ECG74LS74A ECG74LS244 ECG3041	SK74LS14 SK74LS04 SK74LS74A SK74LS244 SK2041/3041	HE-443-872 HE-443-755 HE-443-730 HE-443-791
B11 B13 B17,18 B19 C11	M74LS74AP SN74LS138N HD75154P SN75188N P8259A	NTE74LS74A NTE74LS138 	ECG74LS74A ECG74LS138 	SK74LS74A SK74LS138 	HE-443-730 HE-443-877
C13 C14 C16 C17	SN74LS32N M5L8253P-5 P8259A-5 SN7406N	NTE74LS32 	ECG74LS32 	SK74LS32 	HE-443-794 HE-443-1012
D01 D02 D03 D04 D05					
D06 D07					
D9,17 D18	SN74S04N SN74LS125AN 1NS8250N-B	NTE74S04 NTE74LS125A	ECG74S04 ECG74LS125A	SK74S04 SK74LS125A	HE-443-897 HE-443-811 HE-443-874
E2 E3 E4 E5	M74LS08P M74LS10P SN74LS04N SN74S00N	NTE74LS08 NTE74LS10 NTE74LS04 NTE74S00	ECG74LS08 ECG74LS10 ECG74LS04 ECG74S00	SK74LS08 SK74LS10 SK74LS04 SK74S00	HE-443-780 HE-443-797 HE-443-755 HE-443-26

32 PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.						NOTES
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.		
E6	B6101C084 SN74LS32N SN74LS27N M74LS30P HD74LS244P	NTE74LS32	ECG74LS32	SK74LS32	HE-443-875		
E7		NTE74LS27	ECG74LS27	SK74LS27	HE-443-800		
E8		NTE74LS30	ECG74LS30	SK74LS30	HE-443-732		
E9		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791		
E10,11							
E16	MB64H153 SN74LS32N M74LS08P MC3487N M74LS74AP	NTE74LS32	ECG74LS32	SK74LS32	HE-443-875		
E17		NTE74LS08	ECG74LS08	SK74LS08	HE-443-780		
E18					HE-443-1167		
E19		NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730		
F1		NTE74S74	ECG74S74	SK74S74	HE-443-900		
F2	SN74S74N SN74LS00N SN74S51N SN74LS20N SN74LS04N	NTE74LS00	ECG74LS00	SK74LS00	HE-443-728		
F3		NTE74S51	ECG74S51				
F5		NTE74LS20	ECG74LS20	SK74LS20	HE-443-798		
F8		NTE74LS04	ECG74LS04	SK74LS04	HE-443-755		
F9,10							
F11	M74LS670P M74LS08P SN74LS20N HD7438P M74LS74AP	NTE74LS670	ECG74LS670	SK7CT670	HE-443-1173		
F14		NTE74LS08	ECG74LS08	SK74LS08	HE-443-780		
F17		NTE74LS20	ECG74LS20	SK74LS20	HE-443-798		
F18,19		NTE7438	ECG7438	SK7438	HE-443-77		
G1		NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730		
G2	M74LS395AP M74LS02P M74LS245P HD74LS244P D8288	NTE74LS395A	ECG74LS395A	SK74LS02	HE-443-779		
G3		NTE74LS02	ECG74LS02	SK74LS245	HE-443-885		
G4		NTE74LS245	ECG74LS245	SK74LS244	HE-443-791		
G6		NTE74LS244	ECG74LS244		HE-443-1169		
G7							
G8	SN74LS373N M74LS08P M74LS02P SN74LS20N SN74LS373N HD74LS244P	NTE74LS373	ECG74LS373	SK74LS373	HE-443-867		
G9		NTE74LS08	ECG74LS08	SK74LS08	HE-443-780		
G10		NTE74LS02P	ECG74LS02	SK74LS02	HE-443-779		
G11,12		NTE74LS20N	ECG74LS20	SK74LS20	HE-443-798		
G13		NTE74LS373N	ECG74LS373	SK74LS373	HE-443-867		
G14	HD74LS244P	NTE74LS244	ECG74LS244	SK74LS244	HE-443-791		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.						NOTES
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.		
G15	M74LS240P SN74LS174N HD74LS244P SN74LS273N M74LS245P	NTE74LS240	ECG74LS240	SK74LS240	HE-443-754	USED IN SOME VERSIONS	
G16		NTE74LS174	ECG74LS174	SK74LS174	HE-443-879		
H1		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791		
H2		NTE74LS273	ECG74LS273	SK74LS273	HE-443-805		
H3		NTE74LS245	ECG74LS245	SK74LS245	HE-443-885		
H4	SN74LS125AN SN74LS00N SN74LS139N SN74S08N SN74LS38N	NTE74LS125A	ECG74LS125A	SK74LS125A	HE-443-811		
H5		NTE74LS00	ECG74LS00	SK74LS00	HE-443-728		
H10		NTE74LS139	ECG74LS139	SK74LS139	HE-443-822		
H11		NTE74S08	ECG74S08				
H16		NTE74LS38	ECG74LS38	SK74LS38	HE-443-1034		
H17	D765AC HD61 J228P M58321						
H19							
J3							
J6							
J8	M5L8088S-2 SN74LS04N SN74LS20N P8237A-5 SN74LS32N	NTE74LS04	ECG74LS04	SK74LS04	HE-443-755		
J9		NTE74LS20	ECG74LS20	SK74LS20	HE-443-798		
J10					HE-443-1170		
J15		NTE74LS32	ECG74LS32	SK74LS32	HE-443-875		
K3							
K4	M74LS08P SN74LS00N SN74LS280N M5L27128K	NTE74LS08	ECG74LS08	SK74LS08	HE-443-780		
K10		NTE74LS00	ECG74LS00	SK74LS00	HE-443-728		
K11		NTE74LS280	ECG74LS280	SK74LS280	HE-443-1001		
K16							
K17							
L3	HD14016BP M74LS74AP SN74LS373N HD74LS244P SN74S51N	NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730		
L4		NTE74LS373	ECG74LS373	SK74LS373	HE-443-867		
L5,6,7		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791		
L8							
L10		NTE74S51	ECG74S51				

PRELIMINARY SERVICE CHECKS (Continued)
PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptible power supply may be needed to cure the problem. Do not switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If Disk Drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not clean the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

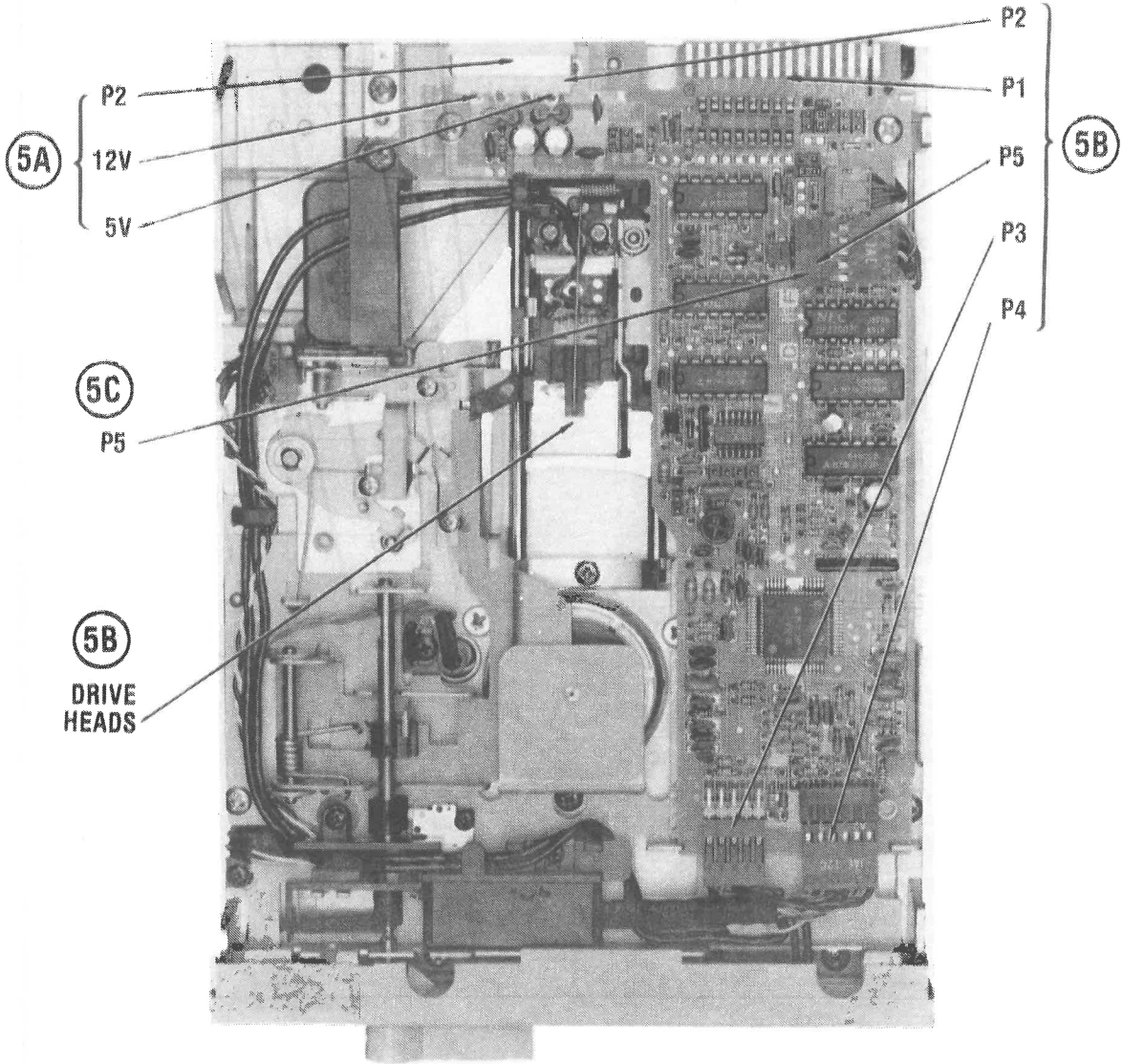
STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

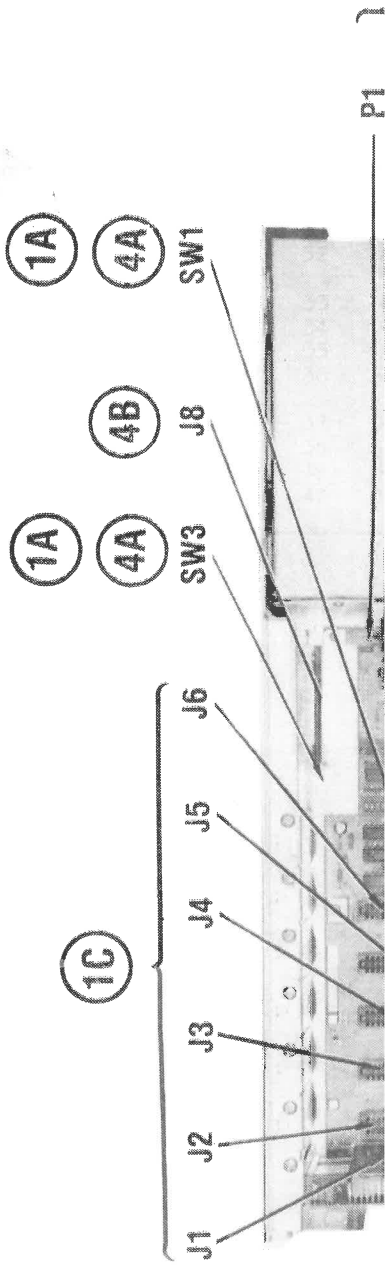
Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

PRELIMINARY SERVICE CHECKS (Continued)



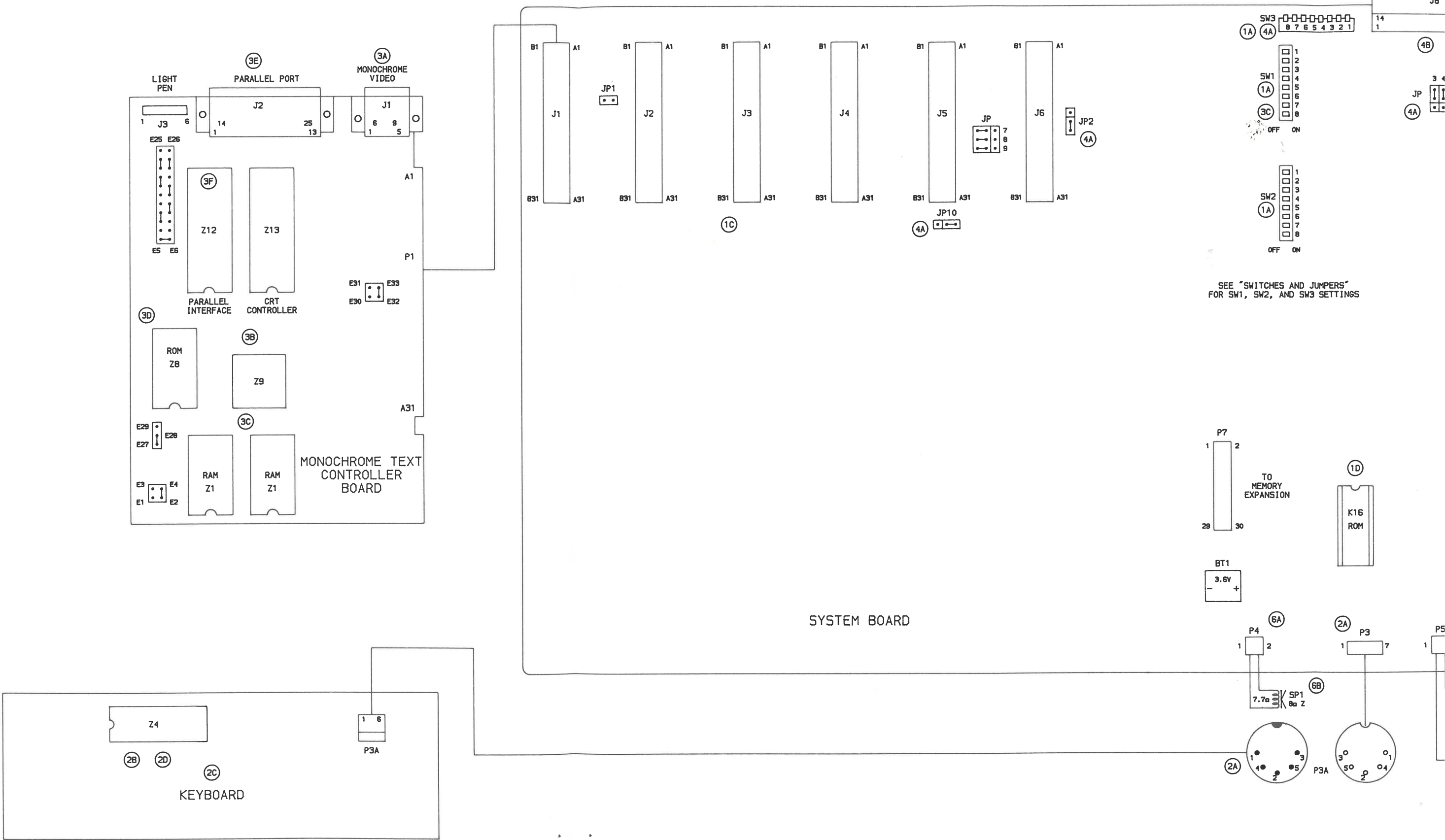
DISK DRIVE -TOP VIEW

PRELIMINARY SERVICE CHECKS (Continued)

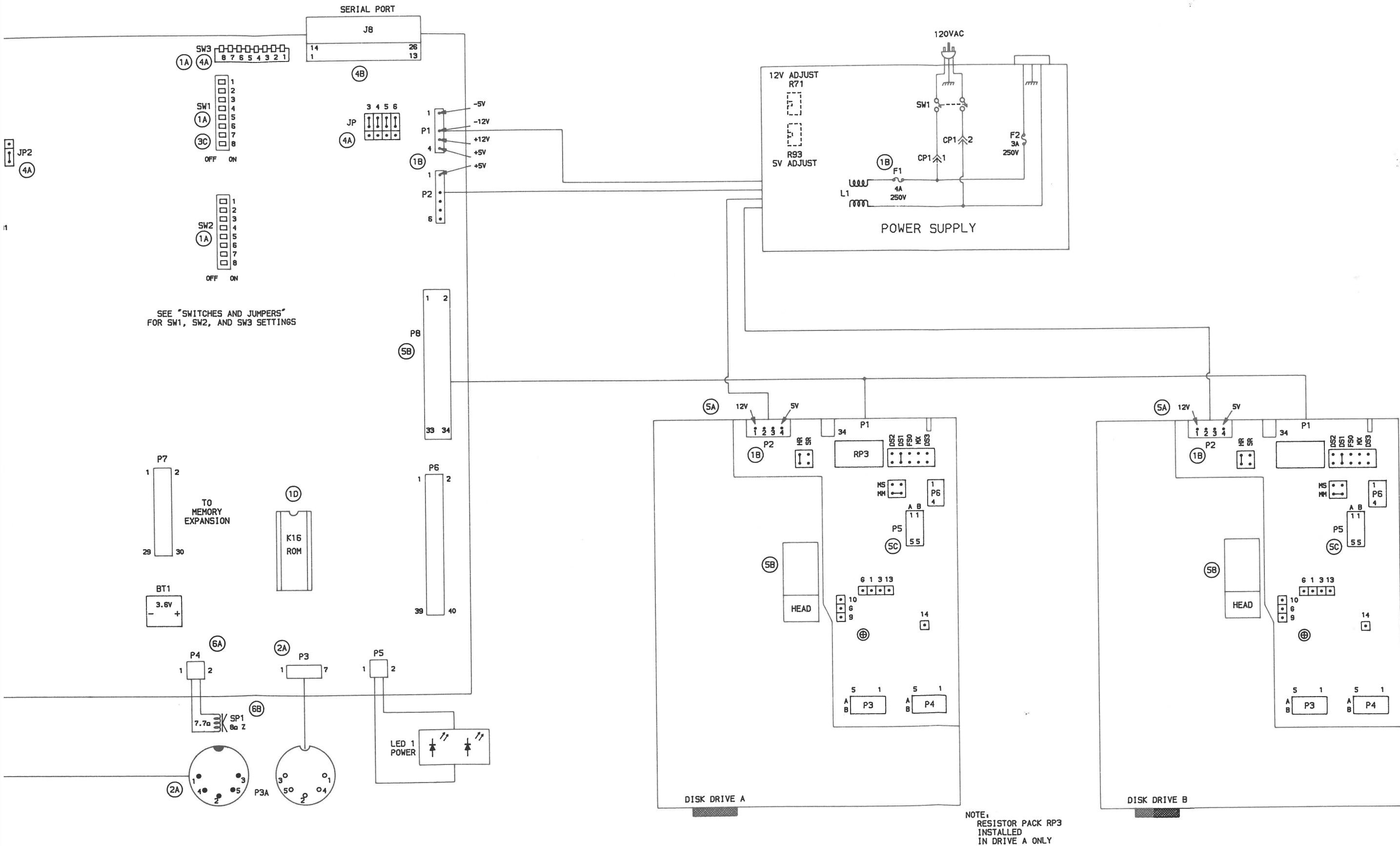


CHASSIS-OVERALL VIEW

PRELIMINARY SERVICE CHECKS (Continued)



ARY SERVICE CHECKS (Continued)



PRELIMINARY SERVICE CHECKS (Continued)
DISASSEMBLY INSTRUCTIONS

MAIN SYSTEM UNIT

Remove five screws from cabinet (one from rear and two from each side). Slide cabinet forward and remove from unit.

POWER SUPPLY REMOVAL

Disconnect Connectors P1 and P2 from System Board and Connector P8 from Disk Drives. Remove four screws from rear of Power Supply cabinet. Push Power Supply forward about 1/2 inch to clear mounting tabs on cabinet bottom and lift Power supply from unit.

POWER SUPPLY

Remove two screws from top left side and three screws from right side of Power Supply case (as viewed with fan on front). Lift top section up and remove. Squeeze in strain relief holding wires on left side and remove. Remove one screw from left front center. Lift up front section (with the fan) about 1/2 inch and slide it forward about three inches. Disconnect AC Connector from lower board (next to fuses). Remove screw holding ground wire from lower board to Power Supply case. Slide front section, with two boards attached, out of case. Remove one screw from center of top board and two screws holding top board to front section. Disconnect Fan Connector from

top board and connector connecting top board to bottom board and remove top board. Remove two screws holding bottom board to front section and remove bottom board.

DISK DRIVE REMOVAL

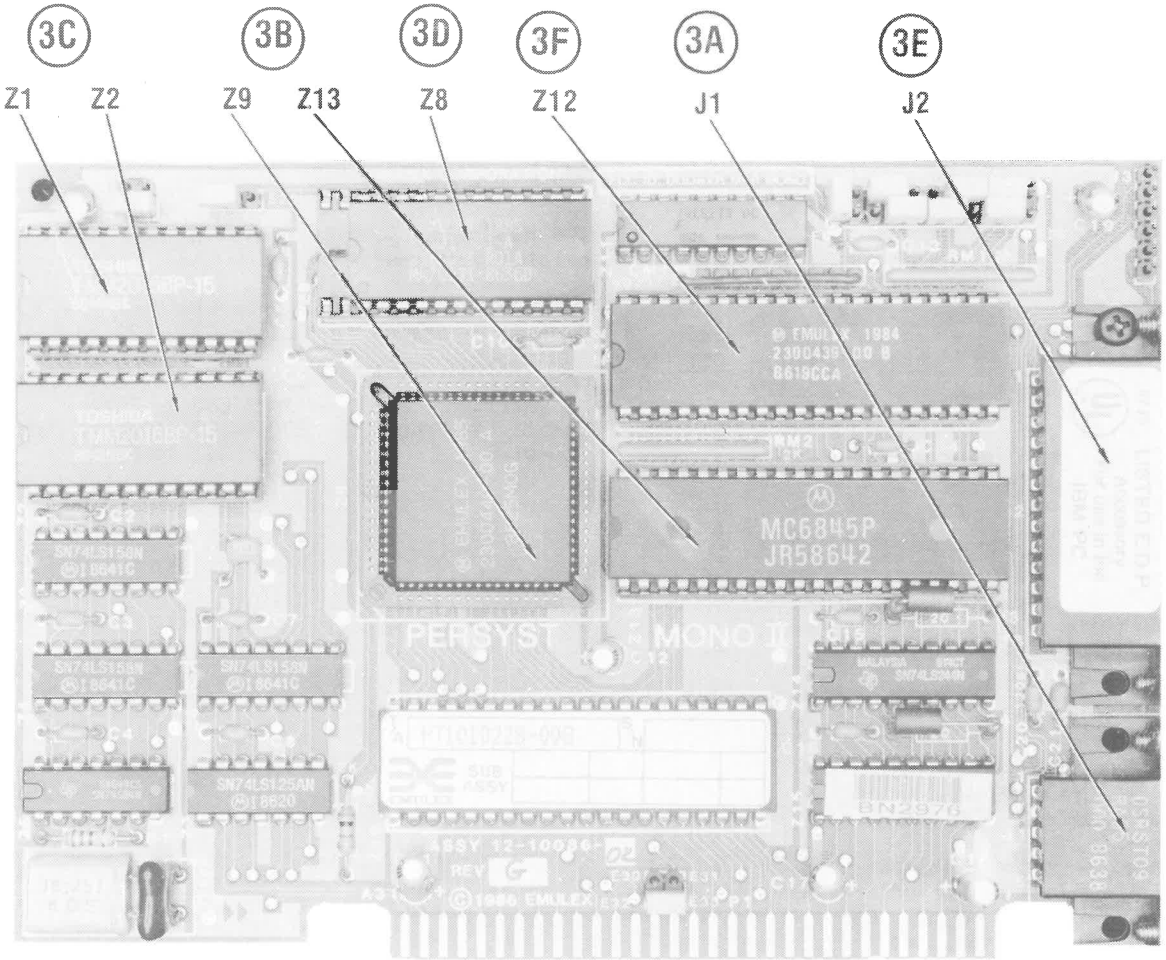
Disconnect Disk Drive Connector and Power Supply Connector from rear of each Disk Drive. Remove two screws from front sides of Disk Drive bracket. Slide Drive bracket forward and remove from chassis. Remove four screws from each side of Drive bracket and remove Disk Drives from bracket.

SYSTEM BOARD REMOVAL

Remove all Adapter boards from expansion slots. Disconnect Disk Drive Connectors and Power Supply Connectors from System Board. Disconnect Speaker Connectors. Remove six screws holding System Board to cabinet bottom. Lift System Board from unit.

KEYBOARD

Lay Keyboard facedown and remove four screws holding lower case. Lift lower case up and out of upper case. Keyboard assembly may now be removed from lower case by removing two screws at each end of assembly.



MONOCHROME TEXT CONTROLLER BOARD

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

MATCH THE NUMBERS ON THE INTERCONNECTING DIAGRAM AND PHOTOS WITH THE NUMBERS ON THE SERVICE CHECKS TO BE PERFORMED.

1 COMPUTER DEAD

- (A) Check DIP Switches SW1, SW2 and SW3 on System Board for correct settings. See "Switches and Jumpers".
- (B) Check power supply voltages at Connectors P1 and P2. Check for -5V at pin 1, -12V at pin 2, 12V at pin 3 and 5V at pin 4 of Connector P1. Check for 5V at pin 1 of Connector P2. If voltages check good, go to step (D). If all voltages are missing, disconnect Connectors P1 and P2 from System Board and Connectors P2A and P2B from Disk Drives and recheck voltages.

NOTE: Pin 4 of Connector P1 will read about 1.6V with no load. If voltages are missing, check Fuse F1 in power supply.

- (C) If power supply voltages check good with Connectors disconnected, remove all plug-in boards from System Board. Reconnect boards and Disk Drives one at a time and recheck power supply voltages until bad board or drive that is causing power supply to shut-down is found.

WARNING: Be sure Computer is turned Off when removing or inserting boards or drives.

- (D) Check ROM IC (K16) on System Board by substitution.

2 KEYBOARD

- (A) Keyboard dead. Check Keyboard cable for continuity and check Keyboard Connector P3.
- (B) If cable checks good, check Microcomputer IC (Z4) by substitution.
- (C) One key does not work. Clean the key contacts.
- (D) One group of keys does not work. Check Microcomputer IC (Z4) by substitution.

3 MONOCHROME TEXT/CONTROLLER BOARD

- (A) No display on Monitor screen. Check Connector J1.
- (B) If Connector J1 is good, check IC's Z9 and Z13 by substitution.

- (C) One or more locations on Monitor screen do not change. Check RAM IC's (Z1 and Z2) by substitution.
- (D) Incorrect characters are displayed on Monitor screen. Check ROM IC (Z8) by substitution.
- (E) Parallel port does not work. Check Connector J2.
- (F) If Connector J2 is good, check Parallel Interface IC (Z12) by substitution.

4 SERIAL PORT

- (A) Serial port does not work. Check settings of Switches 3 and 4 of DIP Switch SW3 on System Board. Check settings of Jumpers JP2, JP3 and JP10 on System Board. See "Switches and Jumpers".
- (B) If Switches and Jumpers are set correctly, check Connector J8.

5 DISK DRIVE

WARNING: It is possible for a defective Disk Drive to write on or erase information on a diskette even when the diskette is write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette.

- (A) Drive is dead. Check for 12V at pin 1 and 5V at pin 4 of Connector P2 on the Disk Drive. If voltages are missing, check Power Supply.
- (B) Disk Drive Operation is erratic. Clean Heads. Check Drive Spindle speed, see "Miscellaneous Adjustments". Check Connectors P1 thru P5 on Disk Drives and Connector P8 on System Board for good connections.
- (C) Head Position Motor Inoperative. Check Connectors P5 and J5.

6 SOUND

- (A) No sound from internal speaker. Check Connector P4 on System Board.
- (B) If Connector P4 is good, check Speaker SP1 winding for continuity.

CSCS20
SPERRY
MODEL HT

PRELIMINARY SERVICE CHECKS (Continued)

GENERAL OPERATING INSTRUCTIONS

SELF-TEST

A Self-Test is automatically performed each time Computer is turned On when Switch 5 of Dip Switch SW3 is set Off. If no problem is found, Computer will beep once and start booting from a diskette inserted in Disk Drive A. If a problem is found, a series of beeps may be heard or an error message may be displayed on Monitor screen.

Beeps
Long Short

0	0	Defective Timer or DMA circuit
1	1	Defective Memory circuit
1	2	Defective Interrupt Controller circuit
1	3	Defective Timer Interrupt circuit
1	4	Keyboard not connected or defective Keyboard circuit
1	5	Defective video RAM on CRT Controller Board
1	6	Defective CRT Controller Board.

BOOT UP

Insert a bootable diskette into Disk Drive A and turn On Computer. The Computer will automatically boot up using diskette in Disk Drive A. If a MS-DOS (Microsoft Disk Operating System) diskette is used, Computer will display date and time and ask for a new date and time. After date and time have been entered, the version of DOS will be displayed on Monitor screen along with an A> which indicates DOS is running.

MS-DOS

For a list of file names on the diskette in current Disk Drive, type DIR and press ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B.

To return to MS-DOS from Basic, type SYSTEM and press ENTER key.

To load a (System) program from a diskette while in DOS, type program name and press ENTER key.

USING BLANK DISKETTES

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press ENTER key. Follow instructions on Monitor screen to format unformatted diskette.

NOTE: Formatting a diskette will wipe out any programs previously placed on diskette. The Computer automatically defaults to Disk Drive A if destination Disk Drive is not specified. Be sure to specify destination Disk Drive of diskette to be formatted or original diskette may be ruined by default action.

BASIC

When turned On, Computer will come up in MS-DOS as long as MS-DOS diskette is in Drive A. The version of MS-DOS will appear at the top of the screen.

The manufacturer also supplies Disk Basic on diskette. To load Disk Basic, first boot up DOS. Insert a diskette with Disk Basic program on it. Type BASIC and press RETURN key or type BASICA and press RETURN key to load Disk Basic. To return to DOS from Basic, type SYSTEM and press ENTER key.

To view a list and names of programs on a diskette in the current Drive, type FILES and press ENTER key. Type FILES "B: *.*" and press ENTER key to list programs from Disk Drive B. Type FILES "A: *.*" to list programs from Disk Drive A if it is not the current (default) drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, program name enclosed in quotes and press ENTER key.

To save a program, type SAVE, program name enclosed in quotes and press ENTER key.

To run a program from any Basic mode, type RUN and press ENTER key. To stop a program, press CTRL and BREAK (SCROLL LOCK) keys at the same time.

NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping program while it is running.

RESETTING COMPUTER

Press CTRL, ALT and DEL keys all three at the same time to reset Computer.

PRELIMINARY SERVICE CHECKS (Continued)
SWITCHES AND JUMPERS

SYSTEM BOARD

There are three DIP switches (SW1, SW2, SW3) located on System Board. SW1 and SW2 must be set according to the number of Disk Drives, type of Monitor Adaptor and amount of RAM memory available. Set SW3 to desired operating modes. Use the following charts to determine the correct Switch settings.

The following switches must be Off:

	SW1	1,3,4		
	SW2	5,6,7,8		
Number of 5-1/4" Drives	SW1 On	SW1 Off		
1	7,8			
2	8	7		
3	7	8		
4		7,8		
	SW1 On	SW2 Off		
RAM				
Less than 640K	2			
With 640K		2		
	SW1 On	SW1 Off		
Monitor Adapter				
None or Enhanced Graphics	5,6			
Display used				
Color Controller Board (40x25)	6	5		
Color Controller Board (80x25)	5	6		
Monochrome		5,6		
	SW2 On	SW2 Off		
SW2				
On Board 256K	1,4	2,3		
Expansion 384K	1,3	2,4		
Expansion 512K	1	2,3,4		
Expansion 640K	1,3,4	2		
	SW3 On	SW3 Off		
SW3				
7.16MHz Clock	8			
4.77MHz Clock		8		
8087 (IC J6) Installed		7		
8087 Not Installed	7			
8087 8MHz Version	6			
8087 5MHz Version		6		
Self-Test On		5		
Self-Test Off	5			
Serial Printer does not use XON/OFF	4			
Serial Printer uses XON/OFF		4		
	SW3 On	SW3 Off		
SW3				
PC Advanced features enabled (high resolution Color Monitor and RS232 XON/OFF enabled)	3			
PC Advanced features disabled		3		
Medium Resolution Monitor or Enhanced Graphics Display used	2			
High Resolution Monitor used		2		
Normal Loading	1			
Self-Test repeats		1		

Serial Port Jumpers

Select COM1 Port	Set Jumper JP10 to pins 1 and 2
Select COM2 Port	Set Jumper JP10 to pins 2 and 3
Select Voltage Interface	Set Jumpers JP3 thru JP6 to pins 1 and 2
Select Current Interface	Set Jumpers JP3 thru JP6 to pins 2 and 3
Enable IRQ3 from Serial Port	Set Jumper JP2 to pins 1 and 2
Enable IRQ4 from Serial Port	Set Jumper JP2 to pins 2 and 3

MONOCHROME TEXT CONTROLLER

Standard Character Set

Jumpers must be installed on the following pins for Standard Character Set:

E2	to E4
E27	to E28
E5	to E6
E9	to E11

Printer Port

Printer port can be configured to one of three addresses by setting jumpers as follows:

Address 3BC to 3BE (Printer 1, LPT1)	E12 to E14, E17 to E19
Address 378 to 37A (Printer 2, LPT2)	E12 to E14, E15 to E17
Address 278 to 27A (Printer 3, LPT3)	E10 to E12, E17 to E19

The following jumpers are also used to control printer port operation:

Printer Interface	E16 to E18
Disable Direction Control	E21 to E23, E22 to E24
Enable Interrupt Level 7	E32 to E33 (Remove Jumper from E30 to E31)
Enable Interrupt Level 5	E30 to E31 (Remove Jumper from E32 to E33)

SPERRY
MODEL HT

MISCELLANEOUS ADJUSTMENTS (Continued)

correct, set Head to Track 00, use a 2.5mm hex screwdriver to loosen Track 00 Sensor (TR22) screw (see Disk Drive Mechanical Photo) on the top of the Disk Drive and adjust the detector until the voltmeter reading jumps from 5.0V to 0V. Tighten Track 00 screw and recheck Track 00 Sensor adjustment.

INDEX SENSOR ADJUSTMENT

Connect Channel A input of a dual-trace scope to TP9, Channel B input to TP14 (Index pulse) and the scope ground to TPG. Set scope display to Channel A with voltage range set to 20mV and sweep time set to 50uSec. Set Channel B input to nonInverting mode and trigger scope on Channel B with the trigger set to positive slope.

Insert Alignment Diskette in Disk Drive and close the door. Turn On Disk Drive, select Side 0 and set Head to Track 34. Confirm that the leading edge of the burst occurs 200us ± 50us after the leading edge of the Index pulse, see Figure 3. If Index Sensor (TR24) is out of adjustment, loosen index sensor retaining nut on the top of the Disk Drive and adjust Index Sensor for 200us ± 50uSec, see Disk Drive Mechanical, Top View Photo. If Side 0 checks good, select Side 1 and repeat above procedure to check Head 1.

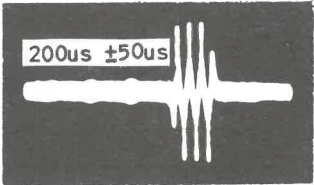


Figure 3

AZIMUTH CHECK

Connect Channel A input of a dual-trace scope to TP9, Channel B input to TP10, external trigger input to TP14 and connect the scope ground to TPG. Set scope to Add mode with Channel B inverted, sweep time to .5mS, AC input, trigger to positive slope and voltage to .1V range.

Insert Alignment Diskette, turn On Disk Drive, select Side 0 and set Head to Track 34. Confirm that the pattern appears as shown in Figure 4. The amplitude of bursts 1 and 4 must be equal to or less than the amplitude of bursts 2 and 3. If the azimuth of Head 0 checks good, select Side 1 and repeat above procedure to check the azimuth of Head 1.

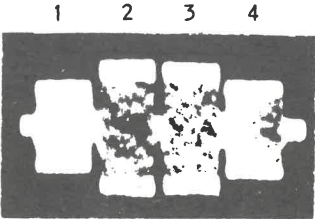


Figure 4

READ CIRCUIT ADJUSTMENT

Connect the input of a cope to TP3. Set scope sweep time to 1uSec, voltage range to 2V and trigger on positive slope. Insert Alignment Diskette in Drive and close the door. Set Drive Head to Track 00 to read the 125kHz (2F) pattern. If Phase Control (VR1) is out of adjustment, the second pulse on the scope screen will appear as two pulses, see Figure B. If VR1 is out of adjustment, adjust it until the second pulse appears as one pulse, see Figure A.

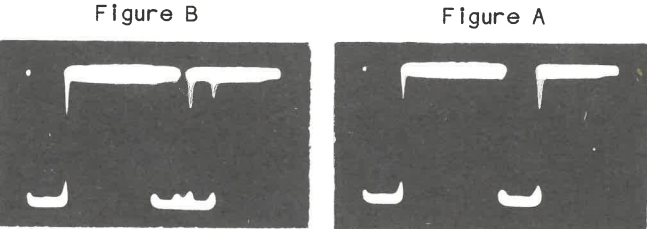
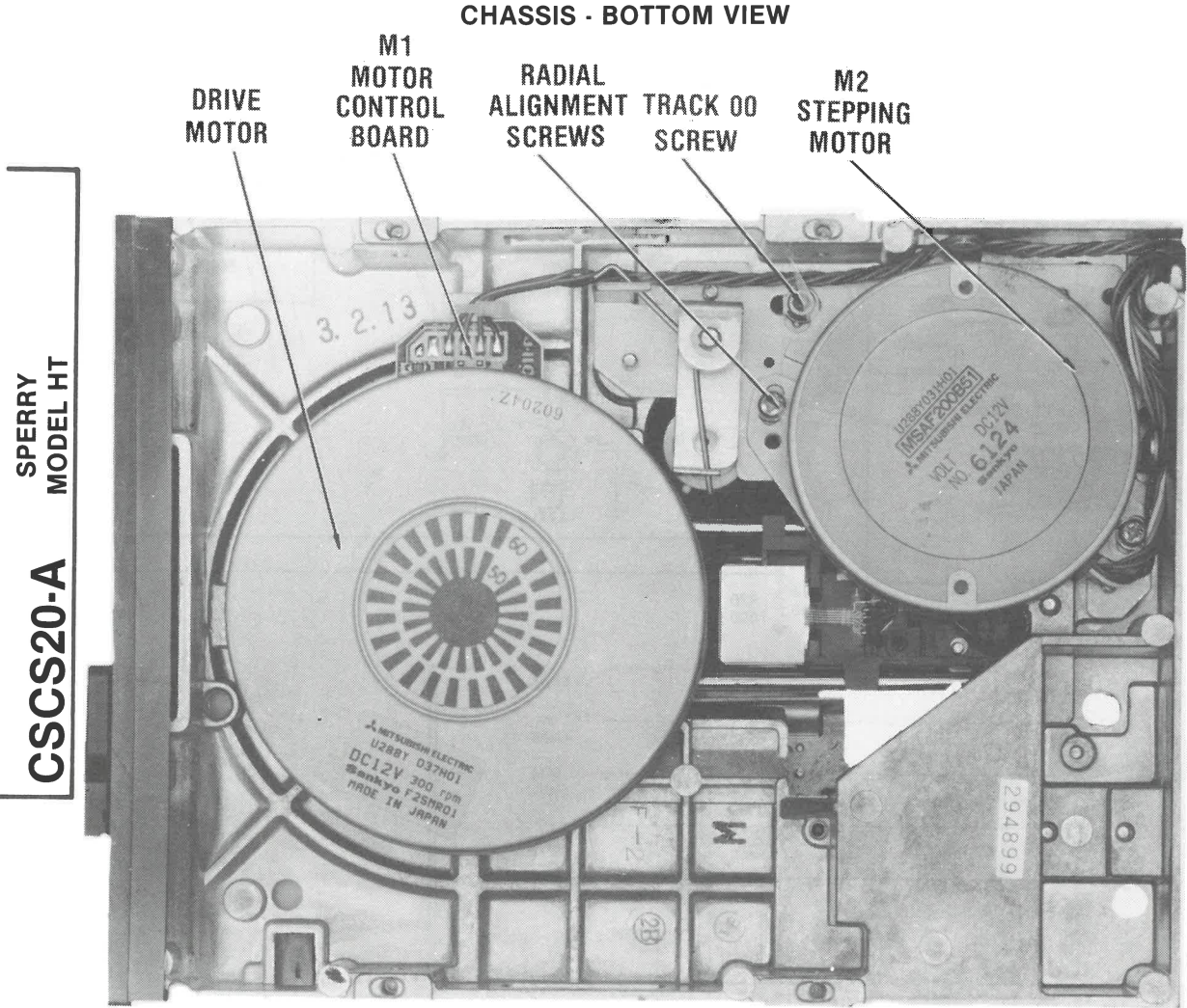


Figure B

Figure A



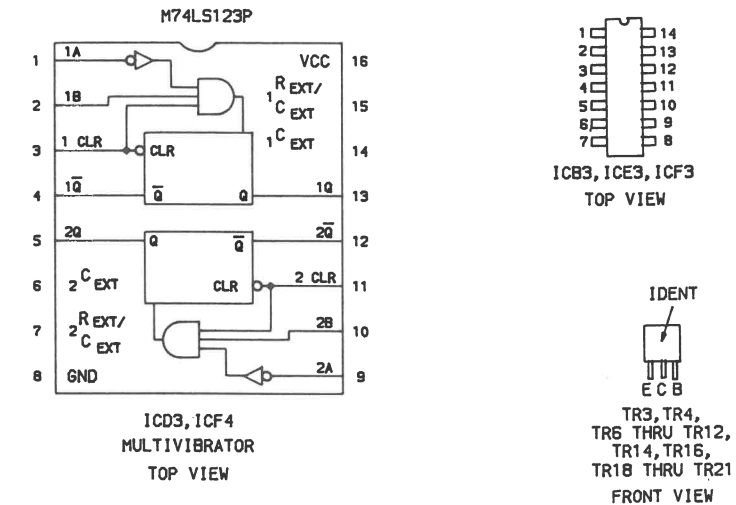
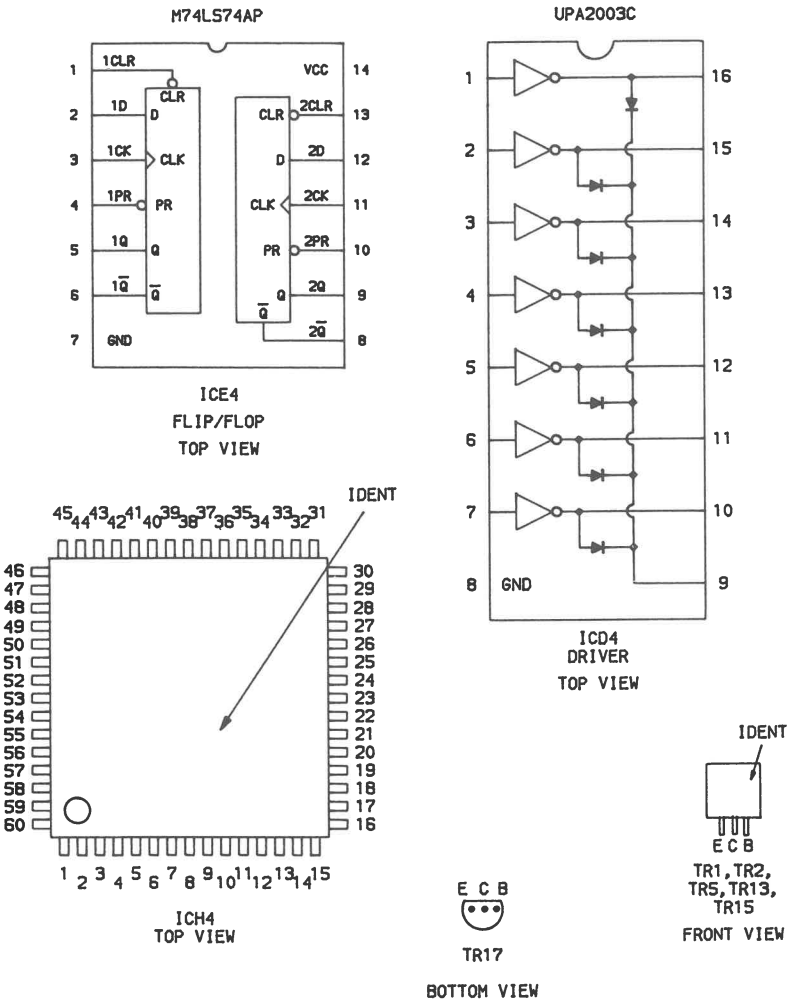
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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co. as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co. by the manufacturers of the particular type of replacement part listed.

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MISCELLANEOUS ADJUSTMENTS

EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive, select side 0 or 1 and step the Head to the track specified in the alignment procedures. When an alignment Diskette is specified in the alignment procedures.

NOTE: This alignment diskette has only alignment patterns on it and does not contain any alignment programs.

DRIVE TRACK PROGRAM

The following Basic programs can be used to step the Disk Drive Head to track specified by the user. To stop program, press CTRL and BREAK keys.

Operates Drive A

```
10 CLS
20 OUT 1014,128:OUT 1010,16:OUT 1010,20
30 OUT 1013,7:S=INP(1012)
40 OUT 1013,1:S=INP(1012)
50 INPUT "ENTER TRACK NUMBER ";TR
60 IF TR>40 THEN 50
70 OUT 1010,20
80 OUT 1013,15:S=INP(1012)
90 OUT 1013,1:S=INP(1012)
100 OUT 1013,TR:S=INP(1012)
110 FOR T=1 TO 400:NEXT T
120 PRINT"PRESS ANY KEY TO STOP"
130 A$=INKEY$:OUT 1010,20:IF A$="" THEN 130
ELSE 50
```

Operates Drive B

```
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 OUT 1013,7:S=INP(1012)
40 OUT 1013,1:S=INP(1012)
50 INPUT "ENTER TRACK NUMBER ";TR
60 IF TR>40 THEN 50
70 OUT 1010,37
80 OUT 1013,15:S=INP(1012)
90 OUT 1013,1:S=INP(1012)
100 OUT 1013,TR:S=INP(1012)
110 FOR T=1 TO 400:NEXT T
120 PRINT"PRESS ANY KEY TO STOP"
130 A$=INKEY$:OUT 1010,37:IF A$="" THEN 130
ELSE 50
```

SPINDLE SPEED CHECK

If a Disk Drive Tester which provides a read-out of the speed in rpm is being used, check for a speed of 300rpm ± 4.5 rpm.

If a Disk Drive Tester is not available, check for a strobe pattern on Drive Motor located on bottom of Drive. If Drive does not have a strobe pattern, center and paste pattern in Figure 1 on Drive Motor.

Insert a diskette into Drive and close the door. Type in and run the program listed under "Continuous Operation of Disk Drive" to keep Disk Drive running. Use the outside pattern when 60-cycle fluorescent lighting is used or the inside pattern for 50-cycle lights. The speed is correct when the pattern appears to stand still.

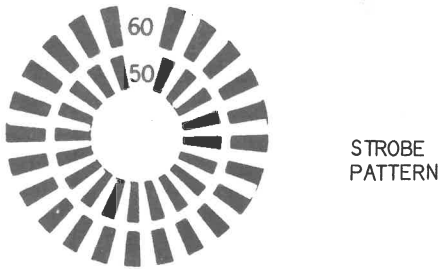


Figure 1

RADIAL HEAD ALIGNMENT

Connect Channel A input of a dual-trace scope to TP9, Channel B to TP10 and the external trigger input to TP14. Set scope to Add mode with one channel inverted, sweep time to 20mSec and voltage range to .2V. Set both scope inputs to AC. Insert Alignment Diskette into Disk Drive and close the door. Turn On Disk Drive and step Head to Track 16, Side 0. The cats-eye pattern shown in Figure 2 should be displayed on the scope.

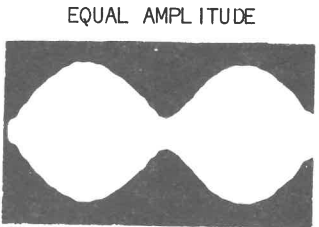


Figure 2

The amplitude of the two lobes displayed must be within 70% of each other. If lobes are out of tolerance, loosen two screws holding Stepping Motor (M2). Adjust Motor until the two lobes are equal in amplitude and tighten Motor mount screws. Check adjustment by stepping Head to Track 39 and back to Track 16, then to Track 00 and back to Track 16, check lobes each time Head is on Track 16. Check Track 00 Stop and Detector adjustments after performing Radial Head Alignment. If Disk Drive is a double-sided drive, select Side 1 using the above procedures.

TRACK 00 SENSOR

Connect a scope to TP9 and set sweep time to 20uSec. Set voltage range to .2V. Insert Alignment Diskette into Disk Drive and close the door. Turn On Disk Drive and set Head to Track 00. A 125kHz sine wave should be displayed on the scope. If the 125kHz signal is not present, step the Head forward or back until the 125kHz signal is present. When the 125kHz signal is present on the scope, Head is on Track 00.

Connect the input of a voltmeter to TP13. Check for 0V when Head is on Track 00 and 5.0V when Head is on Track 01. If readings are not

MISCELLA

correct, set Head to Track 00, screwdriver to loosen Track 00 screw (see Disk Drive Mechanical top of the Disk Drive and adjust until the voltmeter reading jumps 0V. Tighten Track 00 screw and 00 Sensor adjustment.

INDEX SENSOR ADJUSTMENT

Connect Channel A input of a dual-trace scope to TP9, Channel B input to TP14 and the scope ground to TPG. Set scope to Add mode with one channel inverted, sweep time to 20mV and sweep time set to 20mSec. Set both scope inputs to AC. Insert Alignment Diskette into Disk Drive and close the door. Turn On Disk Drive and step Head to Track 16, Side 0. The cats-eye pattern shown in Figure 2 should be displayed on the scope.

Insert Alignment Diskette in Disk Drive and close the door. Turn On Disk Drive and set Head to Track 34, Side 0. The leading edge of the burst should occur 50us after the leading edge of the pulse, see Figure 3. If Index Sensor is out of adjustment, loosen Index Sensor adjusting nut on the top of the Index Sensor. Adjust Index Sensor for 200us. Disk Drive Mechanical, Top View. Side 0 checks good, select Side 1 and repeat above procedure to check Head 1.

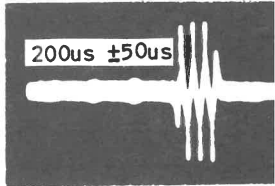
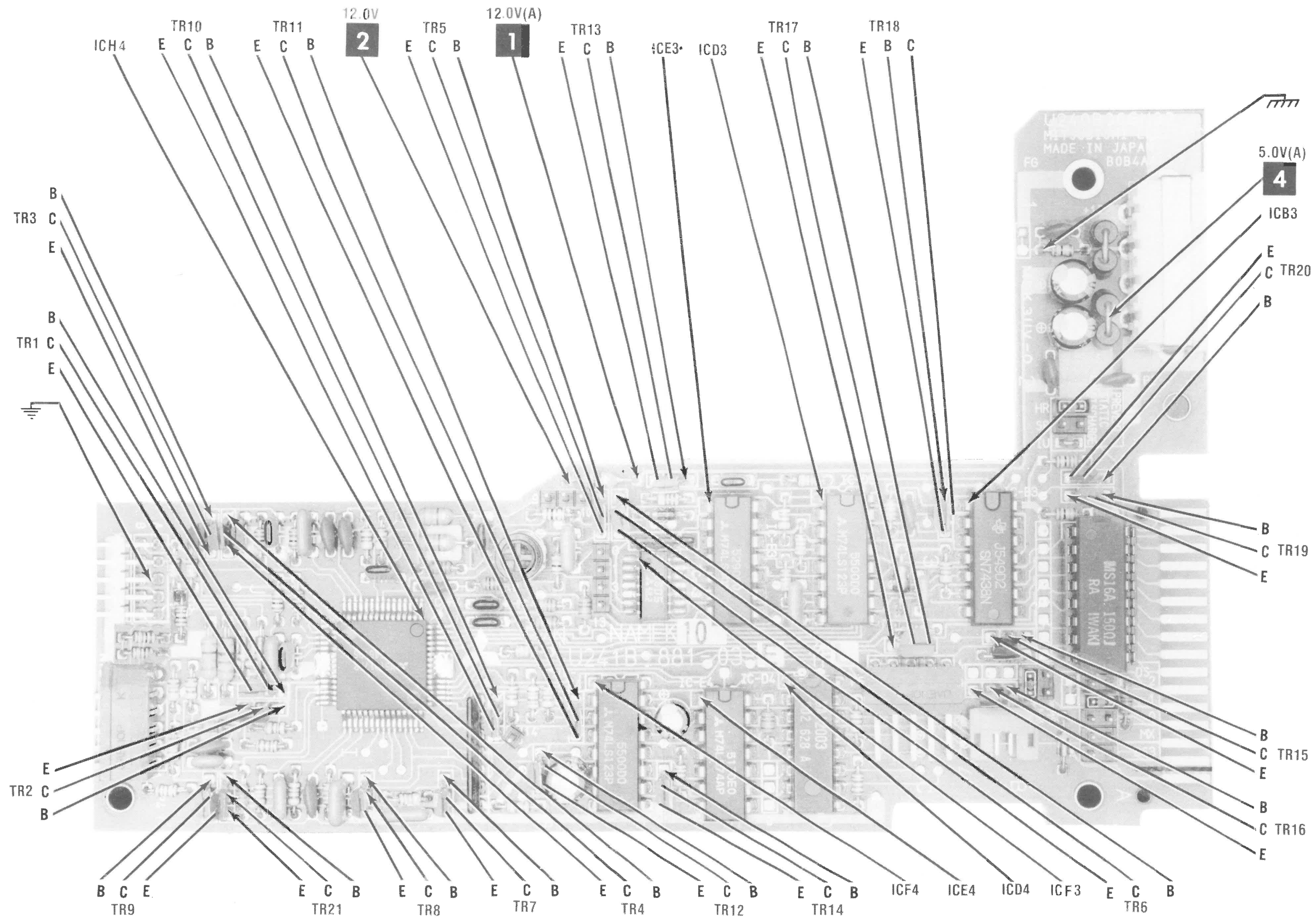


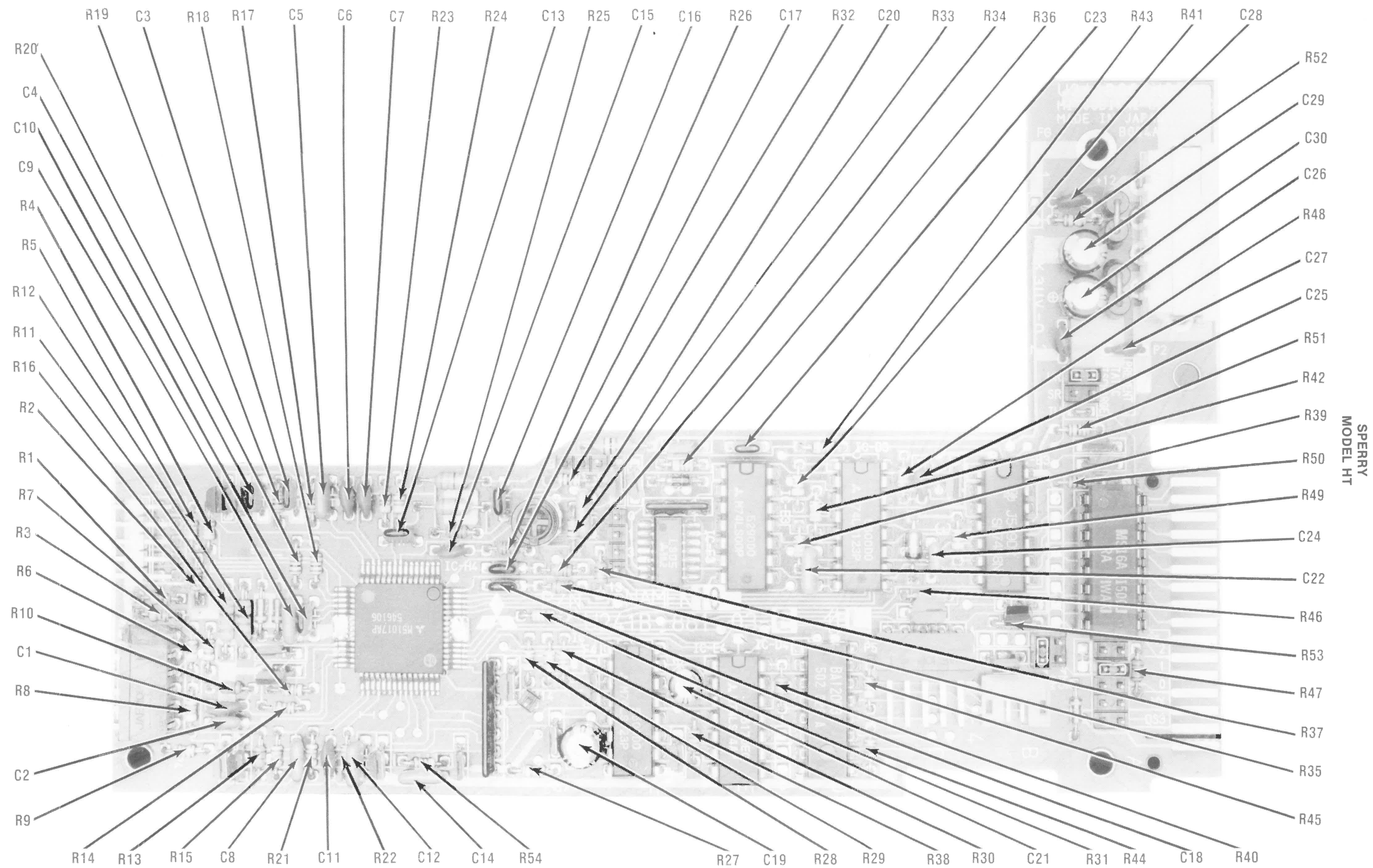
Figure 3

AZIMUTH CHECK

Connect Channel A input of a dual-trace scope to TP9, Channel B input to TP14 and the scope ground to TPG. Set scope to Add mode with one channel inverted, sweep time to 20mV and sweep time set to 20mSec. Set both scope inputs to AC. Insert Alignment Diskette into Disk Drive and close the door. Turn On Disk Drive and set Head to Track 00. A 125kHz sine wave should be displayed on the scope. If the 125kHz signal is not present, step the Head forward or back until the 125kHz signal is present. When the 125kHz signal is present on the scope, Head is on Track 00.



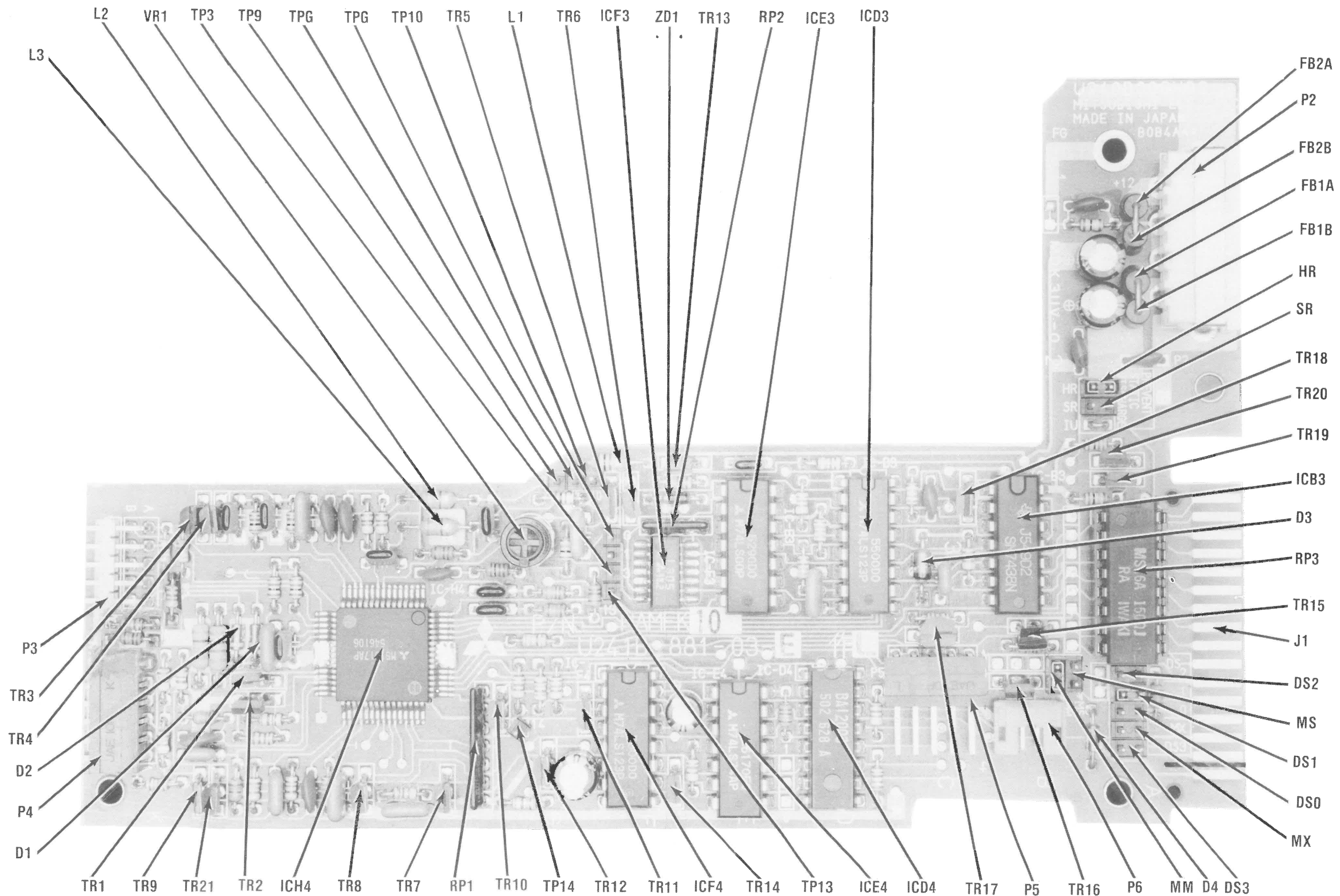
CS20-A
SPERRY
MODEL HT



MAIN BOARD

A Howard W. Sams CIRCUITRACE® Photo

MAIN BOARD



CSCS20-A
SPERRY
MODEL HT

TROUBLESHOOTING

TEST SETUP

Connect a Disk Drive known to be operating properly to Computer as Disk Drive A. Connect defective Disk Drive as Disk Drive B. Use Disk Drive A to load any alignment or test program needed to check defective Disk Drive.

NOTE: If Disk Drive A is not working, DOS and Basic cannot be loaded from the Floppy Disk Drive into Computer in order to run programs. If Disk Drive Interface Circuits are not working, temporarily connect a Hard Disk Controller Board and Hard Disk Drive (with DOS and Basic already installed) to Computer. DOS and Basic can then be loaded from the Hard Disk Drive.

WARNING: It is possible for a defective Disk Drive to write on or erase information on a diskette, even if the diskette is write protected. Check Disk Drive by first using a diskette that has programs that have been backed up on another diskette. Do not leave Alignment Diskette in Drive while checking voltages and waveforms unless specified in the alignment procedures. The test equipment may cause the Disk Drive circuits to erase sections of the Alignment Diskette even if the diskette is write protected.

CONTINUOUS OPERATION OF DISK DRIVE

Use the following Basic program to keep Drive A running continuously in the Read mode. Change the number 20 in the program to number 37 to make Drive B run continuously.

10 OUT 1014,128:OUT 1010,20 GO TO 10

HEAD CLEANING INSTRUCTIONS

Use a cotton swab or lint-free cloth dampened with 90% isopropyl alcohol and dry with a lint-free cloth or use a nonabrasive cleaning diskette.

DRIVE OPERATION ERRATIC

Check for possible dirty Disk Drive Heads. If Heads are dirty, refer to the "Disk Drive Head Cleaning" section. Check the rails that Heads move on for smooth operation. If rails are dirty, use a lint-free cloth and 91% isopropyl alcohol to clean them. If Heads and Head rails check good, check the Disk Drive alignment, see "Disk Drive Alignment".

WILL NOT READ

Verify that the Index Detector circuits are working properly, see "Index Detector".

If Index Detector Circuit is working, run the following Basic program. The program operates Disk Drive B. To operate Disk Drive A, change line 10 to: OUT 1014,128:OUT1010,16:OUT1010,20

10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 OUT 1013,74:S=INP(1012)
40 OUT 1013,Y:S=INP(1012)
50 FOR X=1 TO 7

60 S=INP(1013):S=INP(1012):PRINT S
70 NEXT X:LOCATE 1,1
80 IF Y=1 THEN Y=5 ELSE Y=1
90 GOTO 20

Make all checks while above program is running unless noted otherwise. Insert a Diskette with data on it into Disk Drive and close door. The program continuously reads the Diskette and displays a number on the Monitor screen. The displayed number should not change when there is no diskette in the drive and should change continuously when a diskette (with data on it) is inserted in the Drive.

Check the waveforms at TP9 and TP10 on the Disk Drive Board. If waveforms are missing, check Head windings for continuity, check Connector P3 for good connections, and check voltages and components associated with Switch Transistors (TR3 and TR4) and pins 8 thru 17 of Controller IC (ICH4). If waveforms check good, check for pulses at TP3. If pulses are missing, check voltages and components associated with pins 18, 19, 20 and 26 thru 35 of IC H4. If pulses are present, check for pulses at pins 2 and 3 of IC B3. If pulses are missing at pin 2, check IC E3. If pulses are present at pin 2 and missing at pin 3, check IC B3.

WILL NOT WRITE

Verify that Disk Index Detector Circuits are working, see "Index Detector". Verify that the Drive Oscillator is working, see "Drive Interface Oscillator and Dividers".

Run the following Basic program which writes continuously to a diskette inserted in Drive B and displays a number on the upper left corner of the Monitor screen. The number should be 0 if diskette is not write protected and 2 if diskette is write protected. To operate Drive A, change line 10 to: OUT 1009,16:OUT 1009,20.

WARNING: Do not use diskettes that have important data on them. This program will write over and destroy the data.

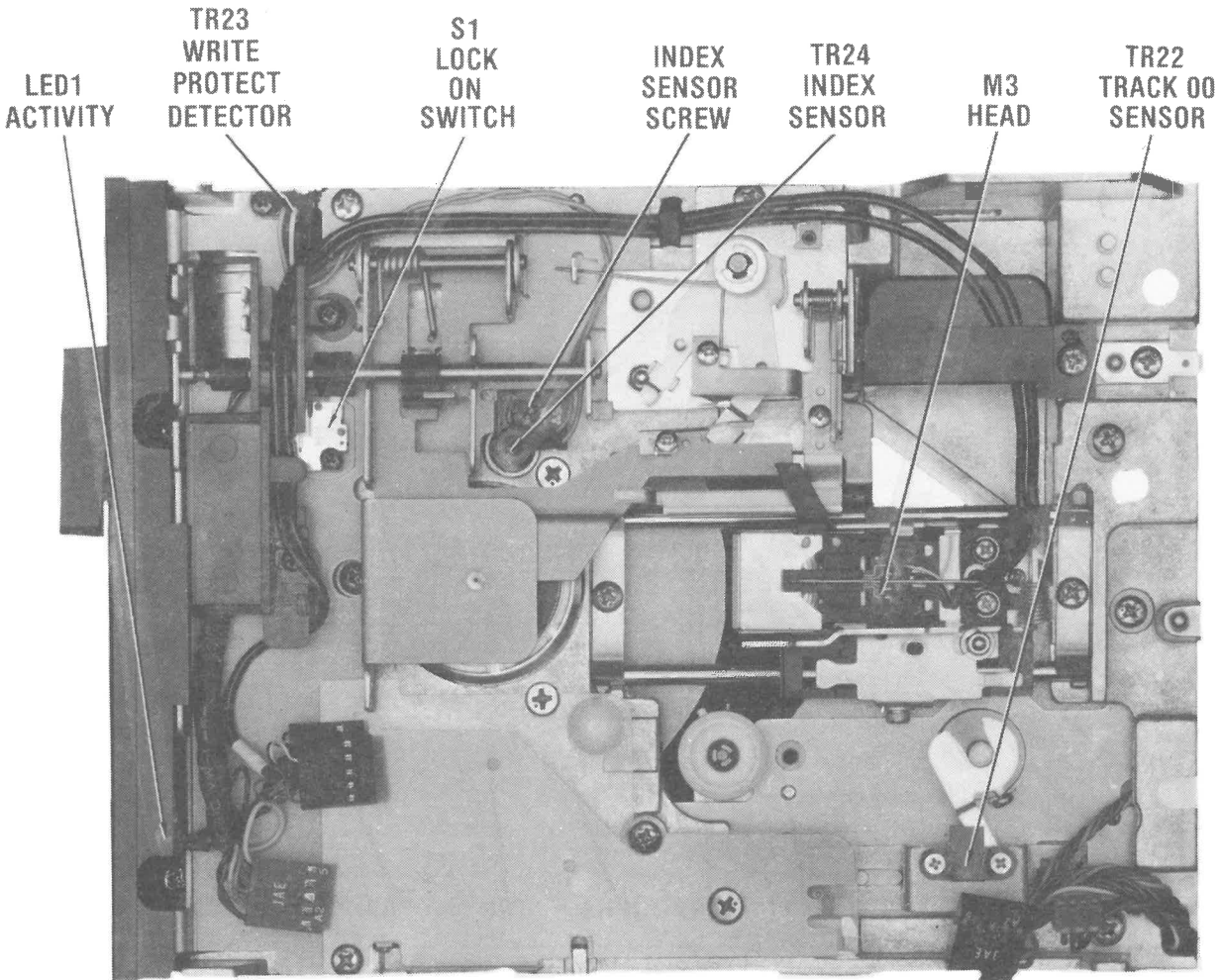
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 S=INP(1012)
40 OUT 1013,77:S=INP(1012)
50 OUT 1013,Y:S=INP(1012)
60 OUT 1013,1:S=INP(1012)
70 OUT 1013,12:S=INP(1012)
80 OUT 1013,12:S=INP(1012)
90 OUT 1013,0:S=INP(1012)
100 S=INP(1013):S=INP(1012)
110 PRINT INP(1013) AND 2:S=INP(1012)
120 FOR X=1 TO 5
130 S=INP(1013):S=INP(1012)
140 NEXT X:LOCATE 1,1
150 IF Y=1 THEN Y=5 ELSE Y=1
160 GOTO 20

NOTE: This program will not write to the diskette if the Diskette Index Detector Circuits are not working. See "Index Detector" section for details on checking the Index Detector Circuits.

LOGIC CHART

DISK DRIVE

PIN NO.	IC B3	IC D3	IC E3	IC F3	IC D4	IC E4	IC F4	IC H4	PIN NO.	IC H4	PIN NO.	IC H4
1	P	L	P	H(5)	L	H	P	0V	21	0V	41	L(2)
2	P	*(1)	P	L(2)	L	H	H	1.6V	22	0V	42	H(7)
3	P	H	P	H(5)	L	P	H	3.5V	23	0V	43	P
4	L	H(1)	L(2)	L(2)	H(5)	H	L	.9V	24	0V	44	L
5	H	L(1)	H(3)	H(5)	L(5)	H	L	2.5V	25	0	45	*
6	H	L	H(4)	L(5)	H(5)	L	L	1.3V	26	11V	46	P
7	L	1.2V	L	L	L(5)	L	1.2V	1.3V	27	6.8V	47	L
8	L	L	H(5)	H	L	L	L	2.6V	28	1.4V	48	H(3)
9	H	L	L(5)	L	H(5)	H	L	2.6V	29	1.3V	49	H(5)
10	H	*(1)	H	H(4)	H(5)	H	H	3.1V	30	5.0V	50	P
11	*	H	H	L(2)	L(5)	H(5)	H	3.2V	31	1.4V	51	L
12	H	H(1)	L	L(2)	H(5)	H	H	3.4V	32	2.3V	52	L
13	L	L(1)	L	H(4)	L(5)	H	H	3.4V	33	5V	53	L
14	H	L	H	H	*(5)	H	L	Vary	34	1.3V	54	L
15		1.2V			*(5)		1.4V	Vary	35	H(1)	55	L
16		H			*(5)		H	Vary	36	H(6)	56	P
17								Vary	37	L(5)	57	H(4)
18								Vary	38	H(5)	58	H(7)
19								12V	39	L(5)	59	P
20								Vary	40	H(5)	60	P(8)



SPERRY
MODEL HT

CHASSIS-TOP VIEW

TROUBLESHOOTING (Continued)

Drive A

10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1010,20
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10

Drive B

10 OUT 1014,128:OUT 1010,33:OUT 1010,37
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T

50 OUT 1010,37
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10

While program is running, check pins 18 and 20 of Connector J1 for good connections. If connections check good, check for pulses at pins 36 thru 39 of Controller IC (ICH4) on Disk Drive Board. If pulses are missing, check ICH4. If pulses are present, check waveforms at pins 10 thru 13 of Drive IC (ICD4). If waveforms are missing, check ICD4. Check Connector P5 for good connections. Check Stepping Motor (M2) windings for continuity and voltages and components associated with Power Amp Transistor (TR17).

SCHEMATIC NOTES

- ▽ Isolated ground.
✕ Circuitry not used in some versions
--- Circuitry used in some versions
• See parts list
≡ Ground

Voltages, waveforms, and logic readings for the Disk Drive Interface and Disk Drive taken while running the following Basic program. Readings shown were taken when the Disk Drive head is not moving unless noted.

NOTE: Insert a formatted diskette (not write protected) in Drive A before running the program.

10 OPEN "A:SAMS.DAT" FOR OUTPUT AS #1
20 FOR X= 1 TO 300
30 PRINT #1, "HOWARD W SAMS"
40 NEXT X
50 CLOSE #1
60 GOTO 10

Voltages measured with digital meter.

Waveforms and voltages taken from ground, unless noted otherwise.

Supply voltage maintained as shown at input.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolystic capacitors are 50 volts or less, 20% unless noted.

Resistors are 1/2W or less, 5% unless noted.

Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights On)

- (1) Probe indicates P when the head goes to track 00.
(2) Probe indicates H when the head is on track 00 and L when off track 00.
(3) Probe indicates L when head is moving in and H when head is moving out from the center of the diskette.
(4) Probe indicates L when the head is on track 00 and H when off track 00.
(5) Probe indicates P when head is moving.
(6) Probe indicates L when head is moving.
(7) Probe indicates L if diskette is write protected.
(8) Probe indicates H when head 0 is selected, L when head 1 is selected.

TROUBLESHOOTING (Continued)

Drive A

10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,20
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40

Drive B

10 OUT 1014,128:OUT 1010,33:OUT 1010,37
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,37
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40

If the number on the Monitor screen is not correct or does not change when Head is moved On and Off Track 00, make the following checks while above program is running.

Check for a logic High at pin 4 of ICE3 on Disk Drive Board, when Head is On Track 00 and logic Low with Head Off Track 00. If readings are not correct, check Track 00 Detector (TR22) and check pins A4, A5, B4 and B5 of Connector P5 for good connections. If readings are correct, check for a logic Low at pin 57 of Controller IC (ICH4) with Head on Track 00 and logic High with Head Off Track 00. If readings are not correct, check ICH4.

DRIVE MOTOR

If Disk Drive A Motor will not turn On. Type in and run the following program:

10 OUT 1014,128:OUT 1010,20:GOTO 10

If Disk Drive B Motor will not turn On. Type in and run the following program:

10 OUT 1014,128:OUT 1010,37:GOTO 10

While program is running, check pins 12 and 16 of Connector J1 for good connections. If connections check good, check for a logic High at pins 5 and 6 of ICB3 on Disk Drive Board. If reading is not correct at pin 5, check Multivibrator IC (ICF4). If reading is correct at pin 5 and not correct at pin 6, check ICB3. If reading is correct at pin 6, check for 3.2V at pin 4 and 2.8V at pin 2 of Connector P6. If voltages are not correct, check Transistors TR15, TR16 and TR18. If voltages are correct, check Motor Control Board (M1).

HEAD POSITION MOTOR

Head Position Motor does not work. Run the appropriate Basic program listed below for Disk Drive (A or B) that is not working. The programs continuously alternate the Disk Drive Head between Tracks 00 and 16.

CSCS20-A
SPERRY
MODEL HT

8 PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
DISK DRIVE						
D1,2						
D3						
D4						
ICB3	M53238P	NTE7438	ECG7438	SK7438	HE-443-77	
ICD3	M74LS123P	NTE74LS123	ECG74LS123	SK74LS123	HE-443-942	
ICD4	UPA2003C					
	[uPA2003C]					
ICE3	M74LS00P	NTE74LS00	ECG74LS00	SK74LS00	HE-443-728	
ICE4	M74LS74AP					
ICF3	LS05	NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
ICF4	M74LS123P	NTE74LS123	ECG74LS123	SK74LS123	HE-443-942	
ICH4	M51017AP					
TR1,2	A143E(DT)					
		NTE289A	ECG289A	SK9137/382	921-1114	
TR3,4	603					
TR5	A143E(DT)					
TR6,7	C143E(DT)					
TR8,9,10	C144E(DT)					
TR11,12	C114E(DT)					
TR13	A143E(DT)					
TR14	C114E(DT)					
TR15	A143E(DT)					
TR16	C144E(DT)					
TR17	A984(JAPAN)					
		NTE290A	ECG290A	SK3114A/290A	121-Z9003	
TR18	C114E(DT)					
TR19	C143E(DT)					
TR20	C114E(DT)					
TR21	C144E(DT)					
ZD1						

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	ITEM No.	RATING	MFGR. PART No.
C3	DISK DRIVE		C13	.001 NPO 50V 5%	
C4	.001 NPO 50V 5%		C16	470 NPO 50V 5%	
C10	.001 NPO 50V 5%		C17	470 NPO 50V 5%	
			C18	150 NPO 50V 5%	
			C23	.001 NPO 50V 5%	

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.	ITEM No.	FUNCTION	MFGR. PART No.
L1	DISK DRIVE		L2	Peaking	
	RF Choke		L3	Peaking	

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR1	DISK DRIVE			
	Phase Adjust	50K		

RESISTORS (Power and Special)

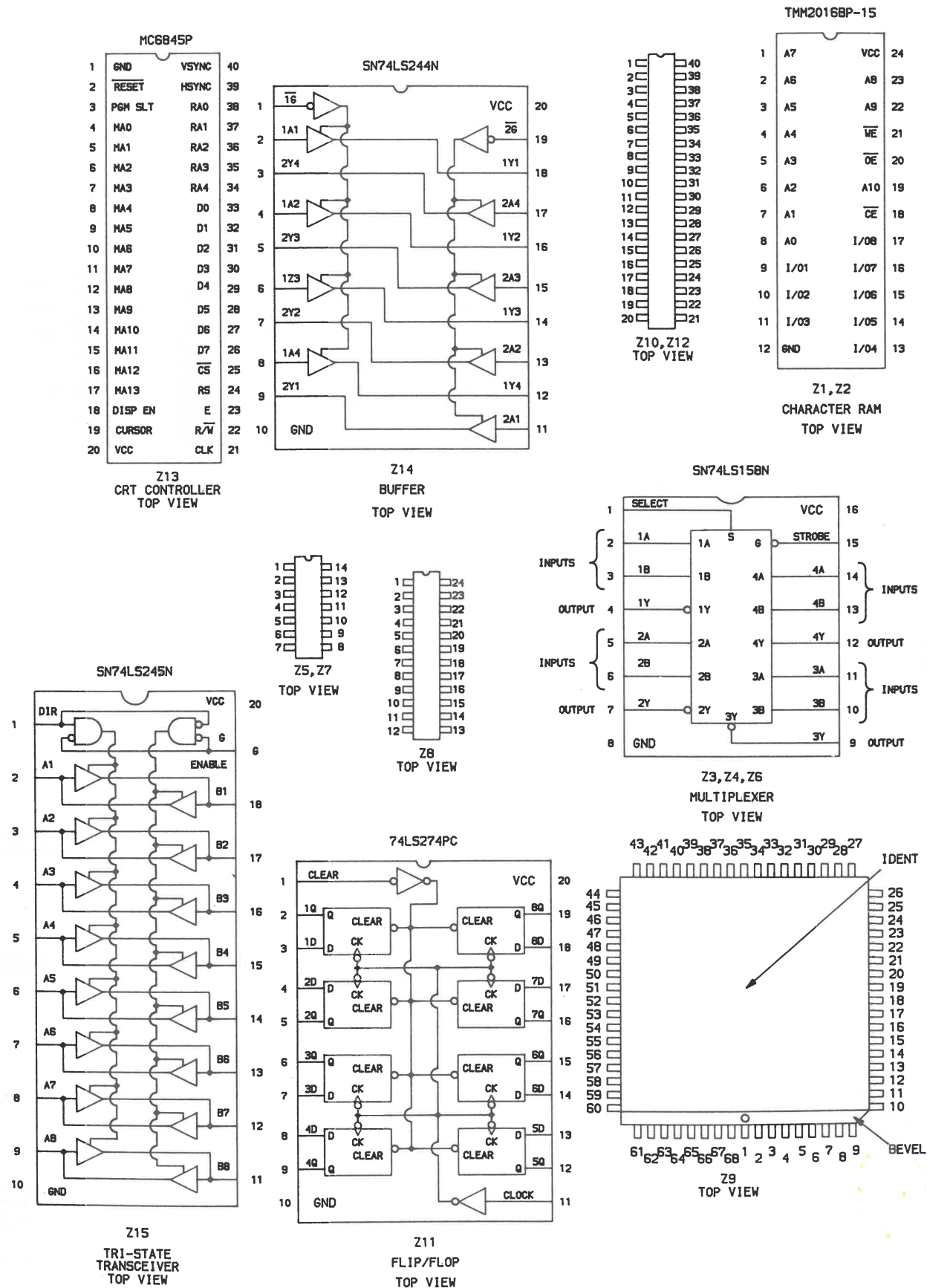
ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R3	150 2% 1/8W Carbon Film		EW115	
R10	47K 20% 1/8W Carbon Film		EW347	
R13	51K 2% 1/8W Carbon Film		EW351	
R25	1500 2% 1/8W Carbon Film		EW215	
R26	100 2% 1/8W Carbon Film		EW110	
R34	3300 2% 1/8W Carbon Film		EW233	
R35	27K 2% 1/8W Carbon Film		EW327	
R37	150 2% 1/8W Carbon Film		EW115	
R40	150 2% 1/8W Carbon Film		EW115	
R47	150 2% 1/8W Carbon Film		EW115	
R53	150 2% 1/8W Carbon Film		EW115	
RP1	Resistor Network	4700 x 5% x 6		
RP2	Resistor Network	2200 x 5% x 2		
RP3	Resistor Network	150 x 5% x 8		

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
	DISK DRIVE		
FB1A	Ferrite Bead		
FB1B	Ferrite Bead		
FB2A	Ferrite Bead		
FB2B	Ferrite Bead		
LED1	LED		
M1	Motor Control Board		Activity
M2	Stepping Motor		
M3	Read/Write/Erase Head		
S1	Switch		
S2	Switch		
TR22	Track 00 Detector		
TR23	Write Protect Sensor		Lever Closed
TR24	Index Sensor		Diskette Sensor

SPERRY
MODEL HT

IC PINOUTS & TERMINAL GUIDES



SAMS

COMPUTERFACTS™

SPERRY
MODEL HT

MONOCHROME TEXT CONTROLLER BOARD

SPERRY
MODEL HT
CSCS20-B

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		Troubleshooting.....	3

CSCS20-B

SPERRY
MODEL HT

SAMS™

Howard W. Sams & Co.

4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

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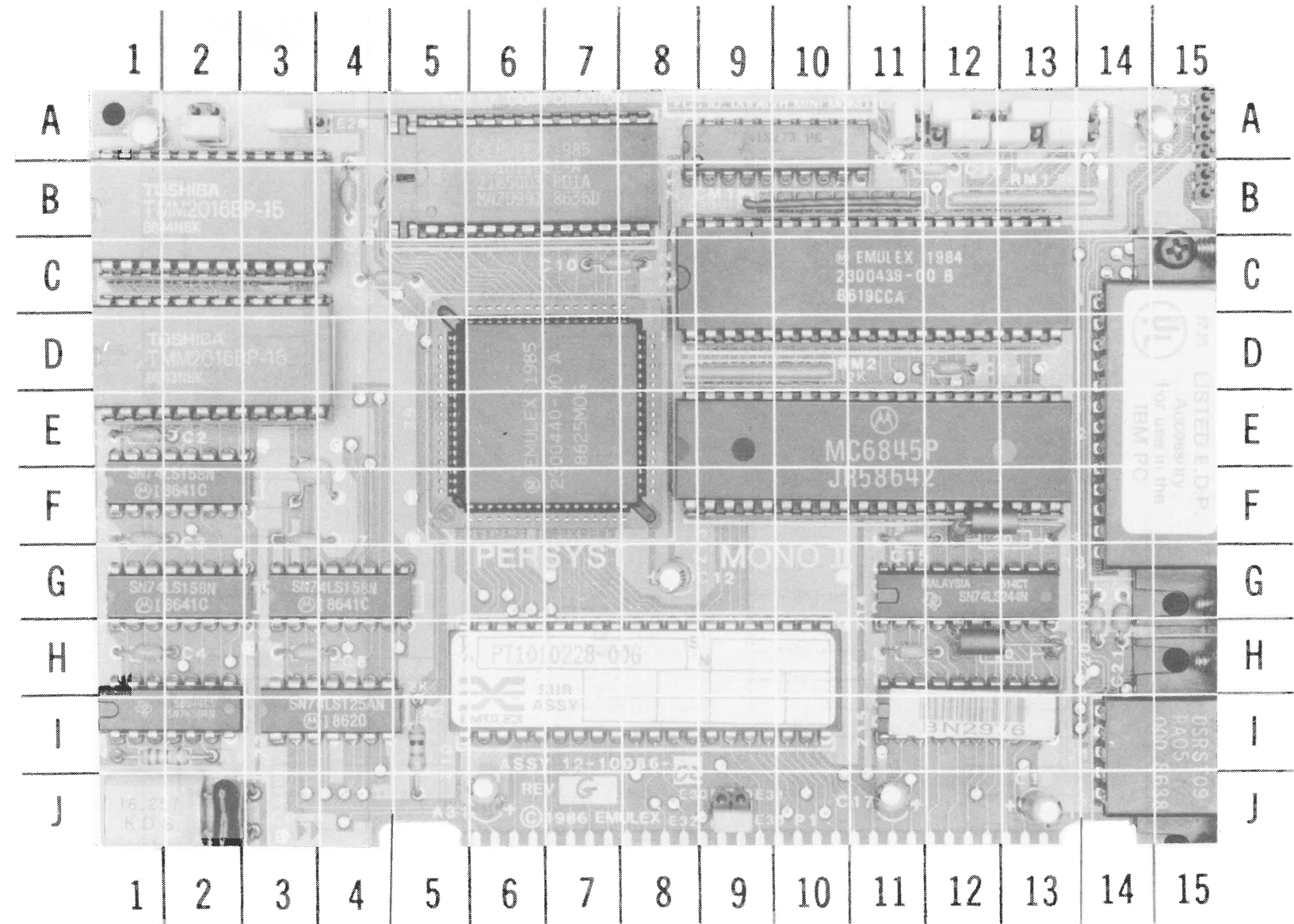
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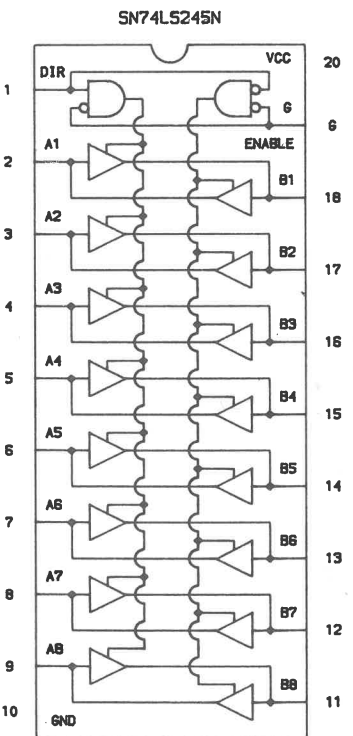
GridTrace LOCATION GUIDE

C1	A-1	Z6	G-3
C2	E-1	Z7	I-3
C3	F-1	Z8	B-6
C4	H-1	Z9	E-6
C5	B-4	Z10	I-6
C6	C-4	Z11	A-9
C7	F-3	Z12	C-9
C8	H-3	Z13	E-9
C9	J-2	Z14	G-11
C10	C-7	Z15	I-11
C11	J-6		
C12	G-8		
C13	B-12		
C14	D-12		
C15	F-11		
C16	H-11		
C17	J-11		
C18	J-13		
C19	A-15		
C20	H-14		
C21	H-14		
C99	E-3		
QM1	B-10		
E1	A-2		
E2	A-2		
E3	A-2		
E4	A-2		
E5	A-11		
E6	A-11		
E7	A-11		
E8	A-11		
E9	A-12		
E10	A-12		
E11	A-12		
E12	A-12		
E13	A-12		
E14	A-12		
E15	A-13		
E16	A-13		
E17	A-13		
E18	A-13		
E19	A-13		
E20	A-13		
E21	A-13		
E22	A-13		
E23	A-14		
E24	A-14		
E25	A-14		
E26	A-14		
E27	A-3		
E28	A-3		
E29	A-4		
E30	J-9		
E31	J-9		
E32	J-9		
E33	J-9		
FB3	F-12		
FB4	H-12		
J1	I-15		
J2	D-15		
J3	A-15		
P1	J-10		
R1	I-1		
R2	I-5		
R3	F-12		
R4	H-13		
RM1	B-13		
RM2	D-9		
Y1	J-1		
Z1	B-1		
Z2	D-1		
Z3	F-1		
Z4	G-1		
Z5	I-1		



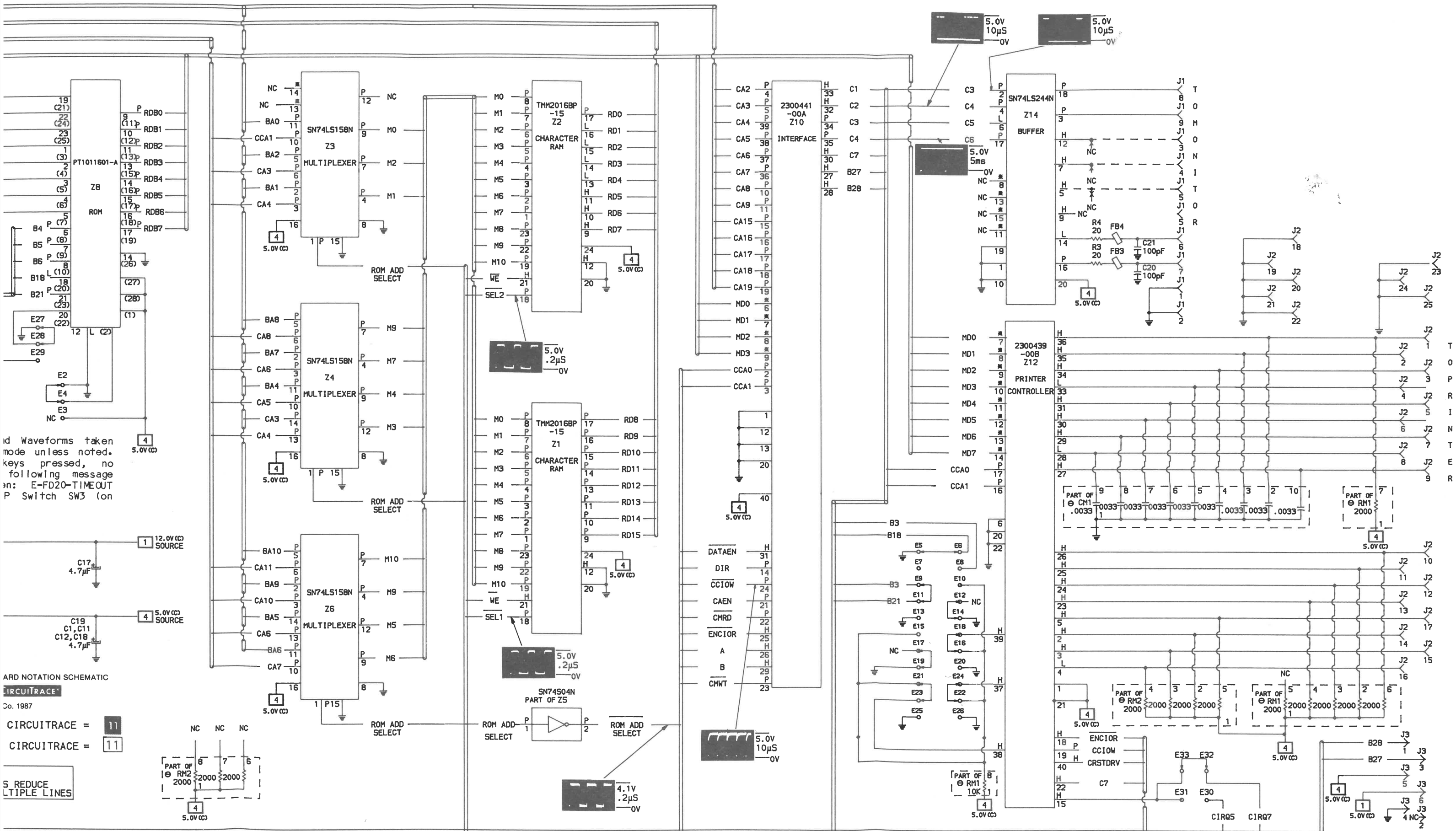
MC6845P			
1	GND	VSYNC	40
2	RESET	HSYNC	39
3	PGM SLT	RA0	38
4	MA0	RA1	37
5	MA1	RA2	36
6	MA2	RA3	35
7	MA3	RA4	34
8	MA4	D0	33
9	MA5	D1	32
10	MA6	D2	31
11	MA7	D3	30
12	MA8	D4	29
13	MA9	D5	28
14	MA10	D6	27
15	MA11	D7	26
16	MA12	CS	25
17	MA13	RS	24
18	DISP EN	E	23
19	CURSOR	R/W	22
20	VCC	CLK	21

Z13
CRT CONTROLLER
TOP VIEW



Z15
TRI-STATE
TRANSCIVER
TOP VIEW





Waveforms taken in test mode unless noted. Keys pressed, no following message on: E-FD20-TIMEOUT P Switch SW3 (on

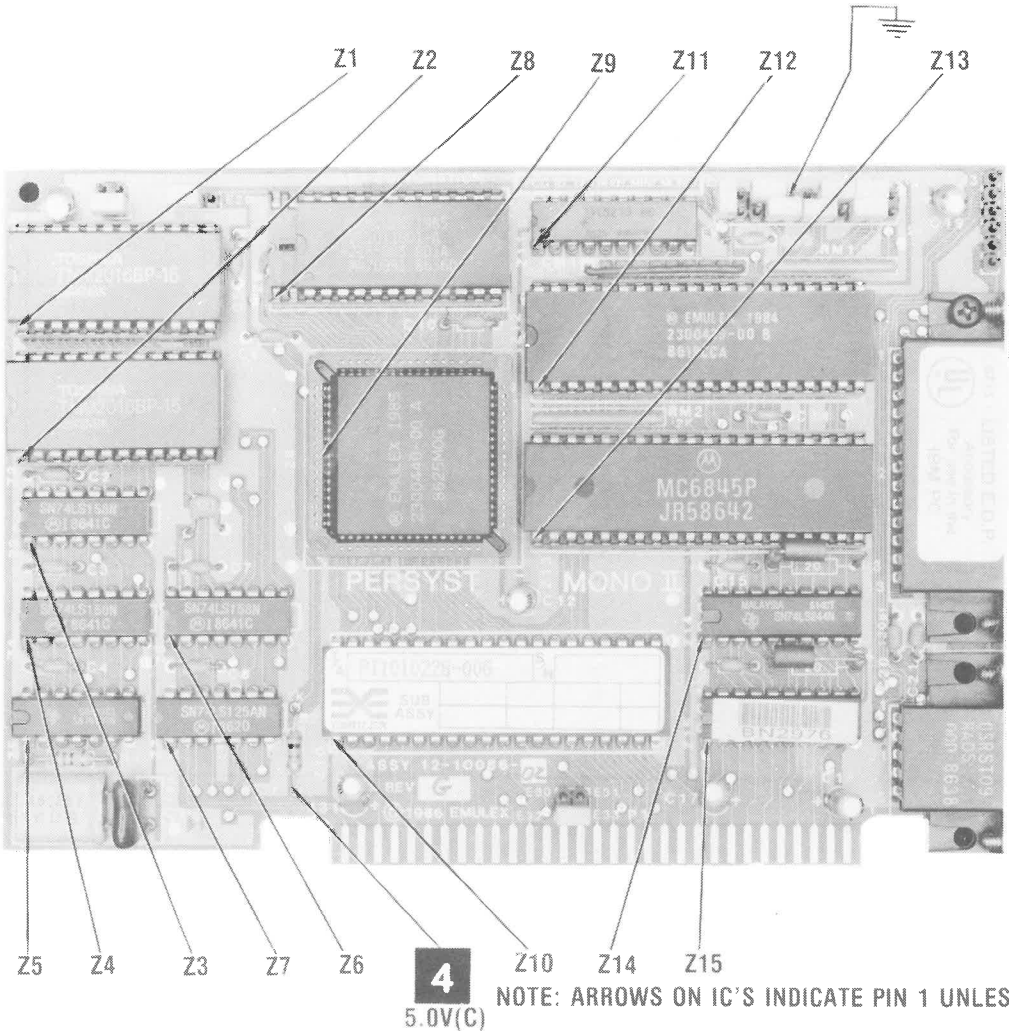
ARD NOTATION SCHEMATIC
"CIRCUITRACE"
Co. 1987

CIRCUITRACE = 11
CIRCUITRACE = 11

5. REDUCE
MULTIPLE LINES

LOGIC CHART (Continued)

PIN NO.	IC Z10	PIN NO.	IC Z10	PIN NO.	IC Z11	IC Z12	PIN NO.	IC Z12	PIN NO.	IC Z13	PIN NO.	IC Z13	PIN NO.	IC Z14	IC Z15
1	L	21	P	1	H	H	21	H	1	L	21	P	1	L	P
2	P	22	P	2	P	H	22	H	2	H	22	P	2	P	P
3	P	23	P	3	P	H	23	H	3	H	23	P	3	P	P
4	P	24	P	4	P	L	24	H	4	P	24	P	4	P	P
5	P	25	H	5	P	H	25	H	5	P	25	H	5	H	P
6	*	26	H	6	P	L	26	H	6	P	26	*	6	L	P
7	*	26	H	7	P	*	27	H	7	P	27	*	7	H	P
8	*	28	H	8	P	*	28	L	8	P	28	*	8	*	P
9	*	29	H	9	P	*	29	H	9	P	29	*	9	H	P
10	P	30	H	10	L	*	30	H	10	P	30	*	10	L	L
11	P	31	H	11	P	*	31	H	11	P	31	*	11	*	*
12	L	32	H	12	P	*	32	L	12	P	32	*	12	H	*
13	L	33	H	13	P	*	33	L	13	P	33	*	13	*	*
14	P	34	P	14	P	*	34	H	14	P	34	L	14	L	*
15	P	35	P	15	P	H	35	H	15	P	35	P	15	*	*
16	P	36	P	16	P	P	36	H	16	L	36	P	16	P	*
17	P	37	P	17	P	P	37	H	17	L	37	P	17	P	*
18	P	38	P	18	P	H	38	H	18	P	38	P	18	P	*
19	P	39	P	19	L	P	39	H	19	P	39	P	19	L	H
20	L	40	H	20	H	L	40	H	20	H	40	P	20	H	H



TROUBLESHOOTING

USING A PRINTER FOR DISPLAY

If there is a defect in the Monochrome Text Controller Board, information that is normally displayed on the Monitor screen may not be visible or readable. In such cases, it may be possible to send the Monitor screen information to a Printer that is connected to the Computer. While Computer is in MS-DOS or GWBasic, the Printer output can be turned On by holding the CTRL Key down and pressing the PrtSc Key. The Monitor screen information will continue to be printed out until the CTRL and PrtSc Keys are pressed again to turn Printer Off. It is also possible to get a printout of the entire screen display by holding SHIFT Key down and pressing the PrtSC Key.

Any Basic program that uses the PRINT command to send information to the Monitor screen can be made to send the information to a Printer by changing the PRINT command to LPRINT.

VIDEO

No video on Monitor screen. Check waveform at pin 4 of Buffer IC (Z14). If waveform is missing, check IC Z9 and CRT Controller IC (Z13). If waveform is correct, check Buffer IC (Z14), Capacitor C20, Resistor R3 and check pin 7 of Connector J1.

VERTICAL SYNC

No vertical sync. Check waveform at pin 40 of CRT Controller IC (Z13). If waveform is missing, check IC Z13. If waveform is present, check waveform at pin 17 of Buffer IC (Z14). If waveform is missing, check Interface IC (Z9). If waveform is correct, check IC Z14 and check pin 9 of Connector J1.

HORIZONTAL SYNC

No horizontal sync. Check waveform at pin 39 of CRT Controller IC (Z13). If waveform is missing, check IC Z13. If waveform is good, check waveform at pin 2 of Buffer IC (Z14). If waveform is missing, check IC Z9. If waveform is correct, check IC Z14 and check pin 8 of Connector J1.

VIDEO RAM

Codes for characters that appear on the Monitor screen are stored in Character RAM IC's (Z1 and Z2). If one or more locations on Monitor screen never change or do not have correct characters, check IC's Z1 and Z2.

The following Basic program can be used to check the video RAM:

```
10 DATA 1,2,4,8,16,32,64,128
20 DEF SEG=&HB000
30 FOR X=0 TO 4096
40 FOR Y=1 TO 8
50 READ Z:POKE X,Z
60 IF PEEK(X) AND Z THEN 80
70 GOTO 120
80 POKE X,0
90 IF PEEK(X) AND Z THEN 120
100 NEXT Y:RESTORE:NEXT X
110 PRINT "MEMORY CHECKS GOOD":END
120 PRINT "RAM CHECKS BAD AT ADDRESS";
    720896 +X
130 GOTO 100
```

PARALLEL PRINTER PORT

Printer port does not work. Check Connector J2. If Connector is good, connect a Parallel Loopback Plug (see Test Plugs) to Connector J2. Type in and run the following Basic program:

```
10 CLS
20 LOCATE 1,1
30 OUT 956,0:OUT 958,0
40 PRINT"A=";INP(956)
50 PRINT"B=";INP(957)
60 PRINT"C=";INP(958)
70 OUT 956,255:OUT 958,255
80 PRINT"D=";INP(956)
90 PRINT"E=";INP(957)
100 PRINT"F=";INP(958)
110 GOTO 20
```

The program continuously checks Printer port circuits and displays six numbers (A thru F) on the Monitor screen. With Parallel Loopback Plug connected, the following numbers should appear:

A=0 B=55 C=192 D=255 E=207 F=255

With Parallel Loopback Plug not connected the following numbers should appear:

A=0 B=127 C=192 C=255 E=127 F=255

If any numbers are not correct, make the following checks while above program is running. Check for pulses at pin 11 of IC Z7. If pulses are missing, check IC Z7. If pulses are present, check for pulses at pin 19 of Printer Controller IC (Z12). If pulses are missing, check IC Z9. If pulses are present, check IC Z12.

TEST PLUGS

Parallel Loopback Plug

Use a male 25-pin subminiature "D" Connector (DB-25) and connect the following pins together: pin 1 to pin 13, pin 2 to pin 15, pin 12 to pin 14, pin 10 to pin 16, pin 11 to pin 17.

CSCS20-B

SPERRY
MODEL HT

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.				
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.
MONOCHROME TEXT CONTROLLER BOARD					
Z1,2 Z3,4 Z5 Z6 Z7	TMM2016BP-15 SN74LS158N SN74S04N SN74LS158N SN74LS125AN	NTE74LS158 NTE74S04 NTE74LS158 NTE74LS125A	ECG74LS158 ECG74S04 ECG74LS158 ECG74LS125A	SK7CT158 SK74S04 SK7CT158 SK74LS125A	HE-443-897 HE-443-811
Z8 Z9 Z10 Z11 Z12	PT1011601-A 2300440-00A 2300441-00A 74LS273PC 2300439-00B	NTE74LS273	ECG74LS273	SK74LS273	HE-443-805
Z13 Z14 Z15	MC6845P SN74LS244N SN74LS245N	NTE74LS244 NTE74LS245	ECG74LS244 ECG74LS245	SK74LS244 SK74LS245	HE-443-906 HE-443-791 HE-443-885

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	ITEM No.	RATING	MFGR. PART No.
CM1	MONOCHROME TEXT CONTROLLER BOARD				
	CAP Network				

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
RM1 RM2	MONOCHROME TEXT CONTROLLER BOARD			
	Resistor Network (1) 2000 x 7 Resistor Network	(1) (1)		

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
FB3 FB4 Y1	MONOCHROME TEXT CONTROLLER BOARD		
	Ferrite Bead		
	Ferrite Bead		
	Crystal		16.257MHz

LOGIC CHART

MONOCHROME TEXT CONTROLLER BOARD

PIN NO.	IC Z1	PIN NO.	IC Z1	PIN NO.	IC Z2	PIN NO.	IC Z2	PIN NO.	IC Z3	IC Z4	IC Z5	IC Z6	IC Z7
1	P	21	H	1	P	21	H	1	P	P	P	P	L
2	P	22	P	2	P	22	P	2	P	P	P	P	P
3	P	23	P	3	P	23	P	3	P	P	P	P	P
4	P	24	H	4	P	24	H	4	P	P	P	P	L
5	P			5	P			5	P	P	L	P	P
6	P			6	P			6	P	P	H	P	P
7	P			7	P			7	P	P	L	P	L
8	P			8	P			8	L	L	L	L	P
9	P			9	H			9	P	P	*	P	P
10	P			10	H			10	P	P	P	P	L
11	P			11	H			11	P	P	P	P	H
12	L			12	L			12	L	P	P	P	H
13	P			13	L			13	*	P	P	P	P
14	P			14	L			14	*	P	H	P	H
15	P			15	L			15	L	L		L	
16	P			16	L			16	H	H		H	
17	P			17	P								
18	P			18	P								
19	P			19	P								
20	L			20	L								

PIN NO.	IC Z8	PIN NO.	IC Z8	PIN NO.	IC Z9	PIN NO.	IC Z9	PIN NO.	IC Z9	PIN NO.	IC Z9
1	P	21	P	1	L	21	H	41	H	61	H
2	P	22	P	2	H	22	P	42	P	62	P
3	P	23	P	3	H	23	P	43	P	63	H
4	P	24	H	4	H	24	P	44	P	64	P
5	P			5	H	25	P	45	P	65	P
6	P			6	L	26	P	46	P	66	L
7	P			7	P	27	P	47	P	67	L
8	P			8	P	28	L	48	P	68	L
9	P			9	P	29	P	49	P		
10	P			10	H	30	P	50	P		
11	P			11	H	31	P	51	P		
12	L			12	P	32	*	52	P		
13	P			13	P	33	*	53	P		
14	P			14	P	34	*	54	P		
15	P			15	L	35	*	55	P		
16	P			16	H	36	*	56	P		
17	P			17	P	37	*	57	P		
18	L			18	L	38	*	58	P		
19	L			19	P	39	*	59	P		
20	L			20	H	40	P	60	P		

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